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THE TOOL ENGINEER

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October, 1949
Vol. XXIII No. 4.

Editorial

Ideas as a Cost-Cutting Tool

WITHIN A FEW WEEKS of the mailing of this issue, the Seventeeth Semi-Annual meeting of ASTE will open in Montreal. Both the United States and Canada will be represented by speakers in the technical sessions, and the overall theme of their presentations will be cutting costs in limited production.

The selection of this theme was not accidental; in the recent years since the war, production costs have been the paramount preoccupation of industry after industry. In many plants the inability to reduce costs sufficiently has resulted in serious financial difficulties; in the majority of cases this could have been avoided.

High costs have been the result of product and design changes, new production problems, materials scarcities, as well as the inability, in many instances, to obtain immediate delivery of needed equipment. Increased overhead and rising labor rates have contributed to the need for an overall offensive against the swollen price tag.

It is one of the primary responsibilties of the tool engineer to take the lead in this fight against excessive production costs. His ability to exchange technical data on a professional level provides the ammunition. As a result, never has such emphasis been placed on chapter and national meetings to provide new and better ideas for the tool engineer. Never has the industrial exposition assumed such importance, as it will next April, in its campaign to offer him the newest and best in tooling for increased production at lowered cost.

Papers at the Montreal meeting include practical operating information on dies, materials, surface control and estimating of low-cost tooling. Economics of low-cost tooling, machining, quality control are included. Plant tours offer a direct means of observing actual production.

Tool engineers will find that these ASTE seminars offer a substantial aid in their daily operating problems. A significant reason for the growth of tool engineering is that prominent tool engineers realize, and profit from, this fact.

The efficiency of any man can be increased by the interchange of ideas with men of his own profession. Therefore, it is important to take advantage of this opportunity to profit from the experience of others.

October 27-29 will find at Montreal a cross-section of the tool engineering talent of the United States and Canada. They will return from the meeting with a considerable broadening of viewpoint, and with a portfolio of ideas in direct proportion to their own contribution. It is upon this free exchange of ideas that the future of tool engineering lies.

R. B. Douglas

President 1948-49

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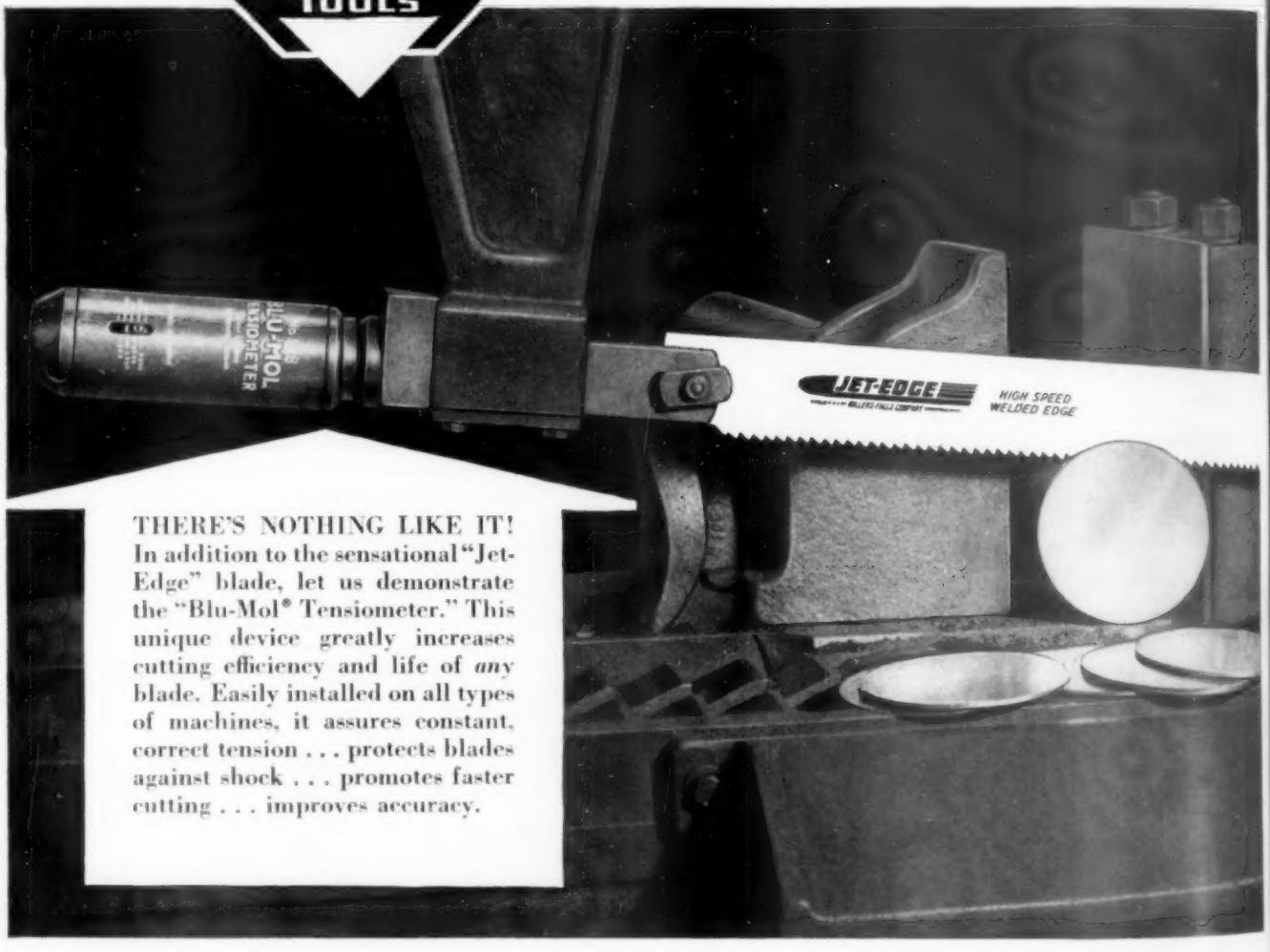

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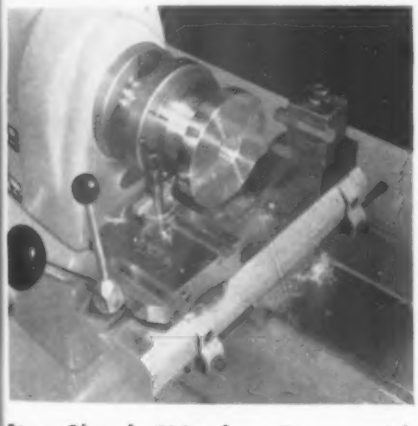

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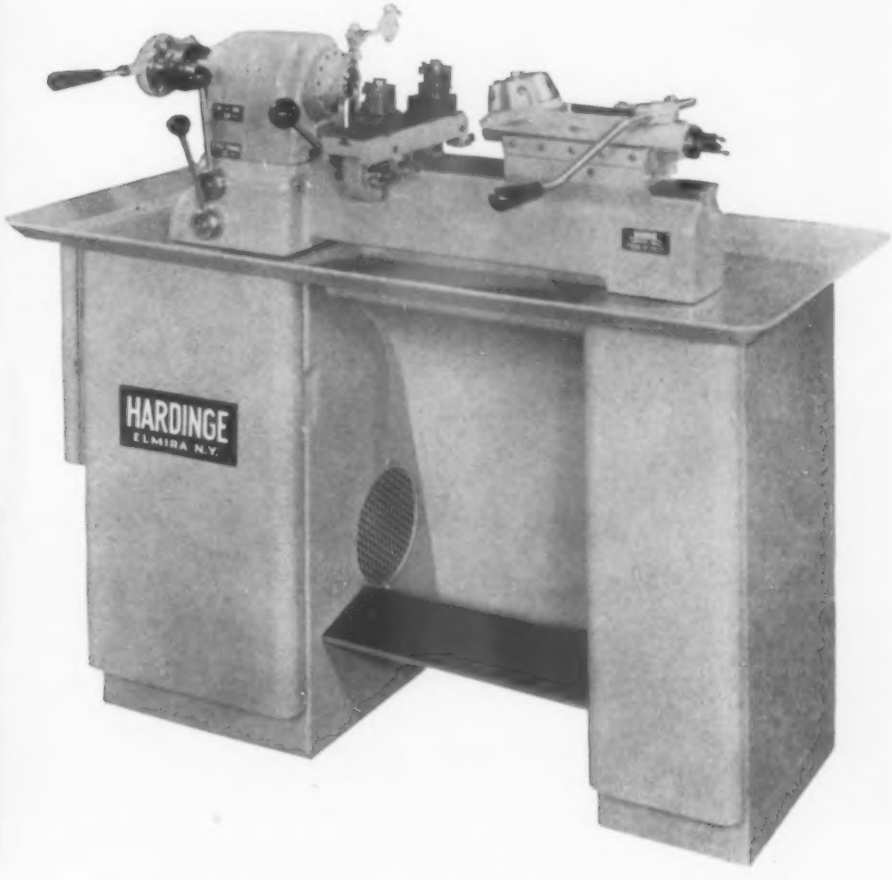

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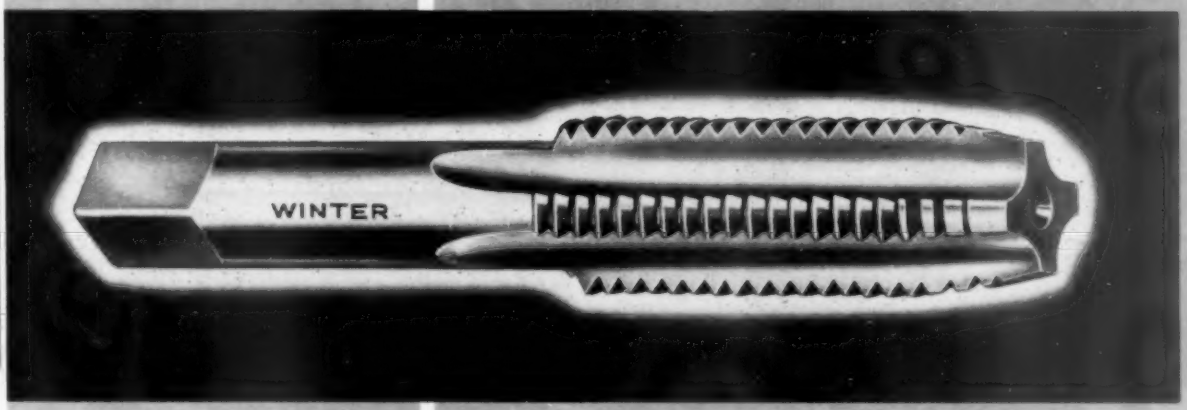

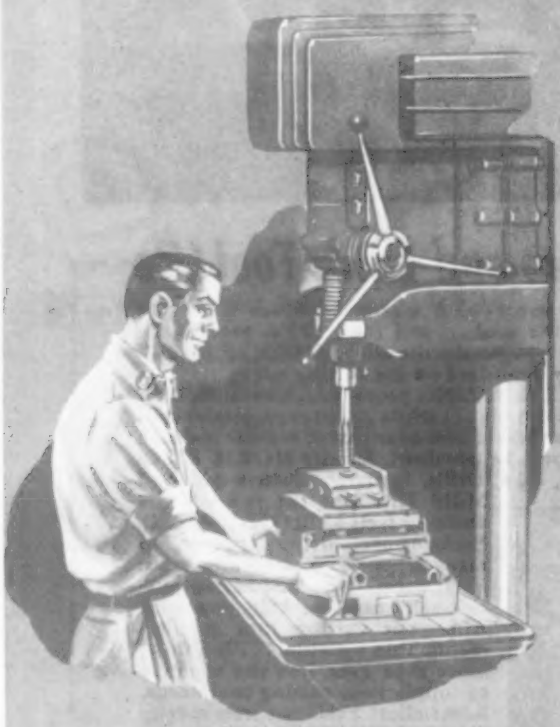

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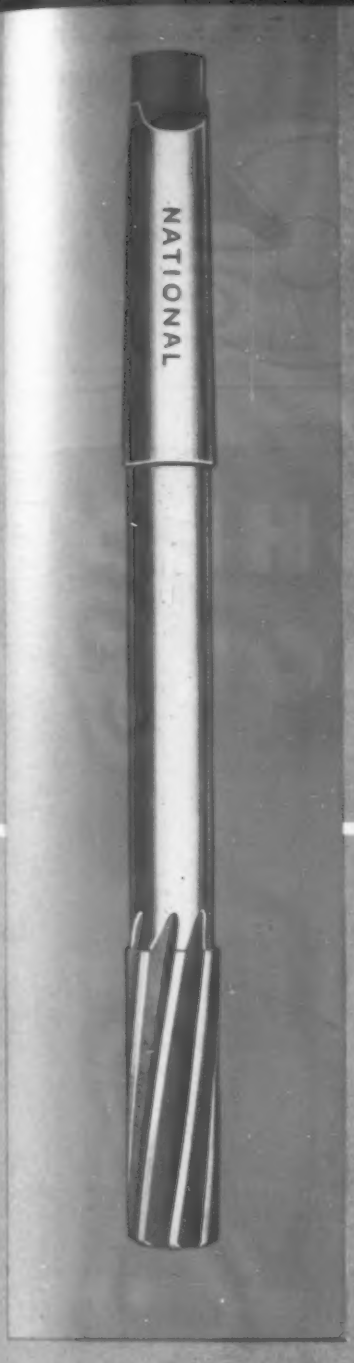

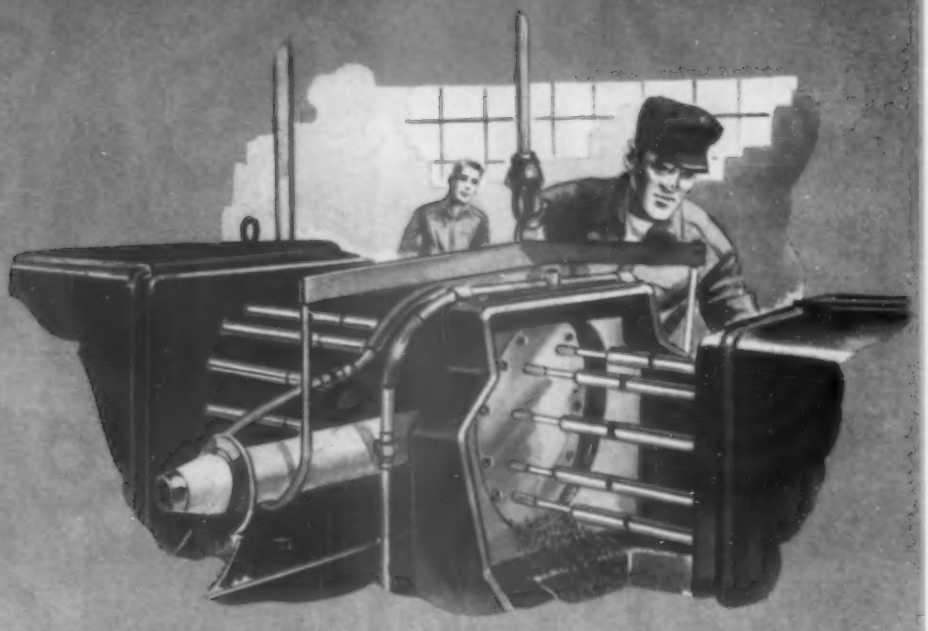

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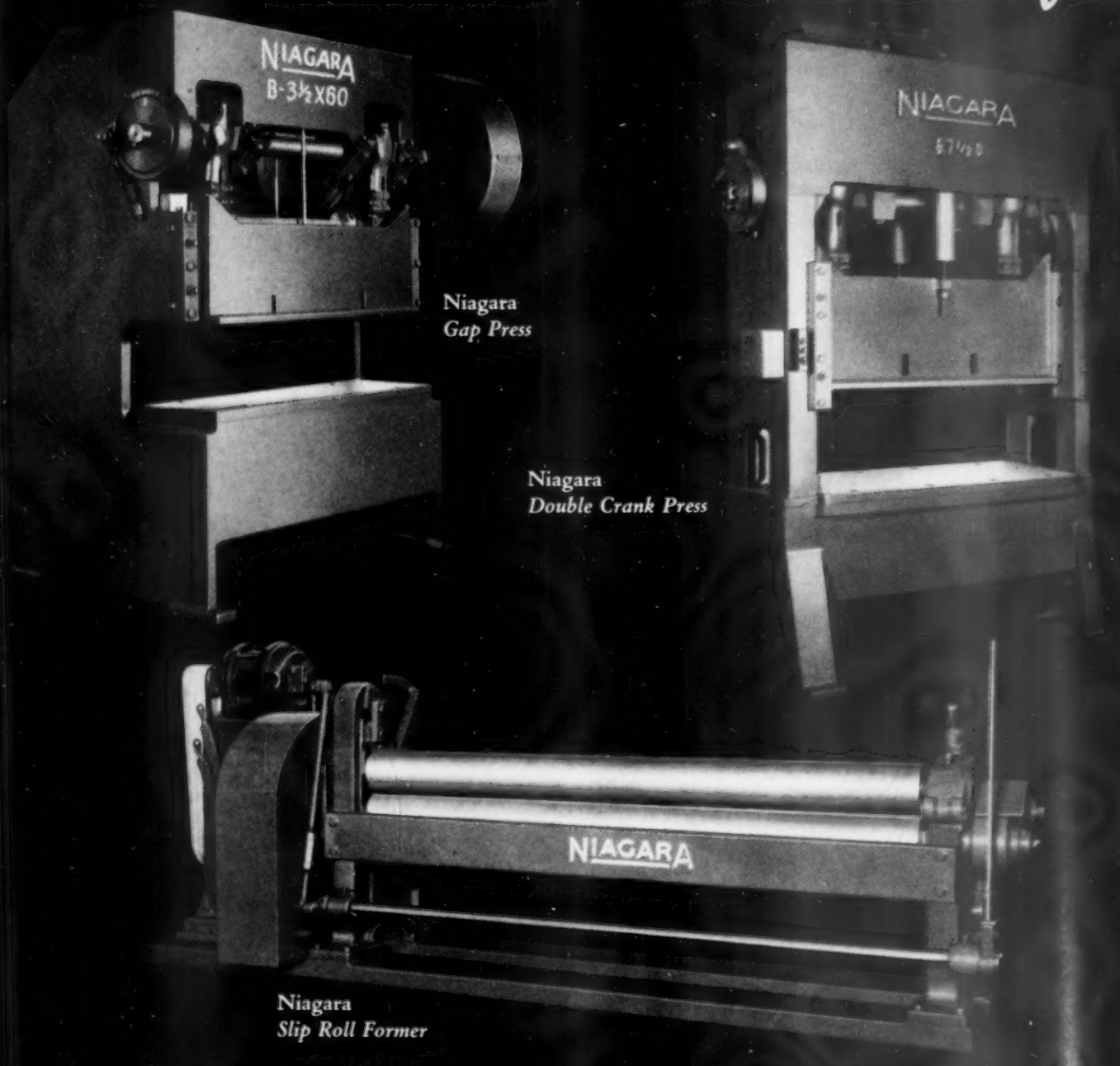

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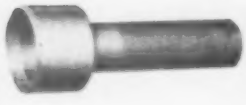

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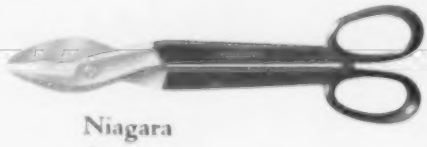

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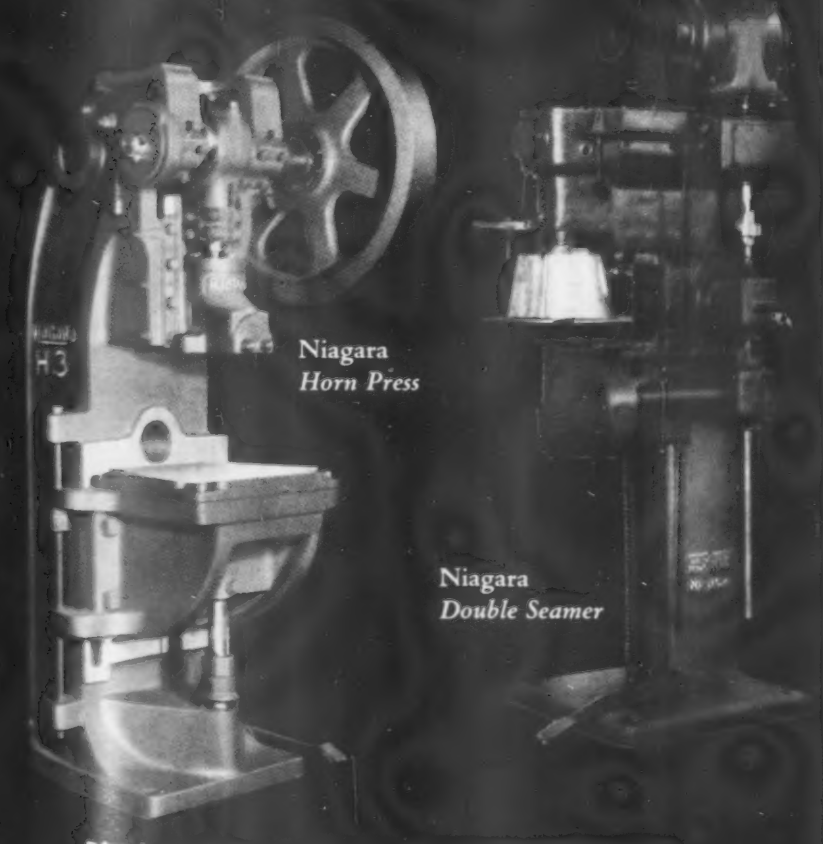

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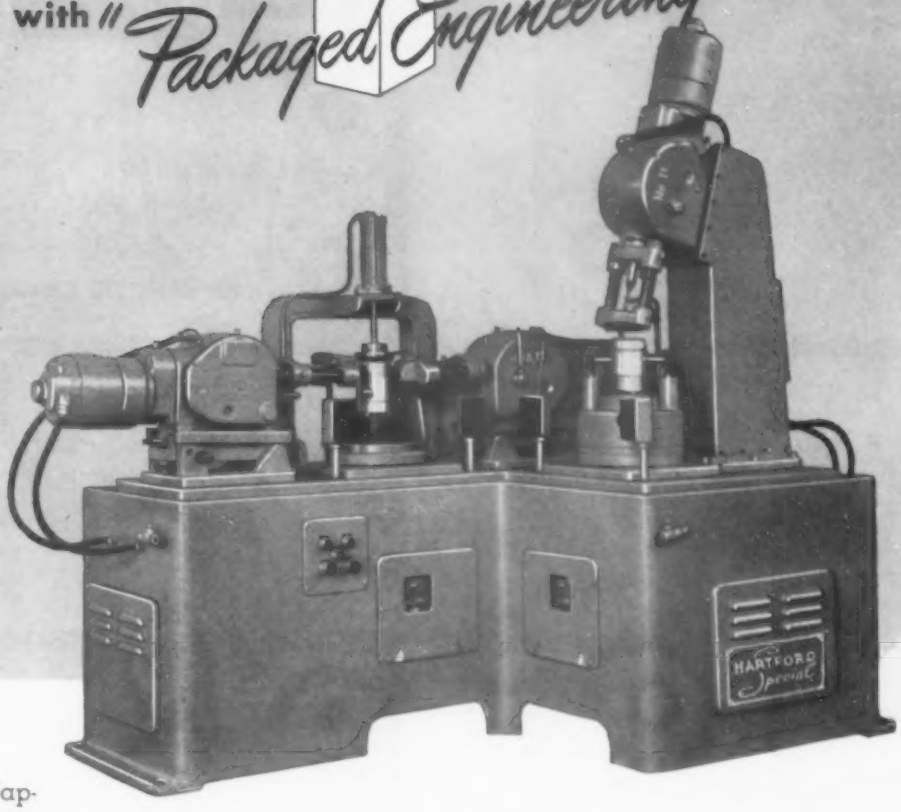

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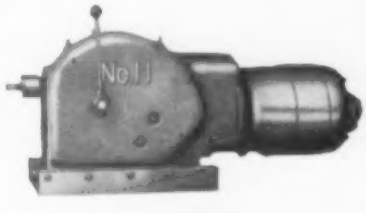

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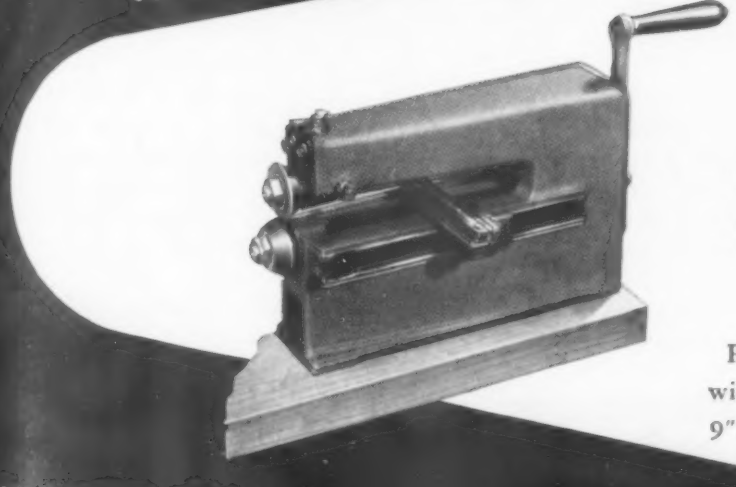

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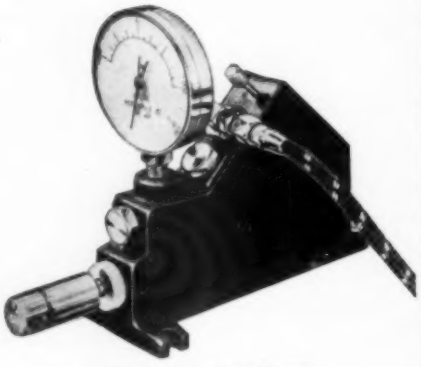

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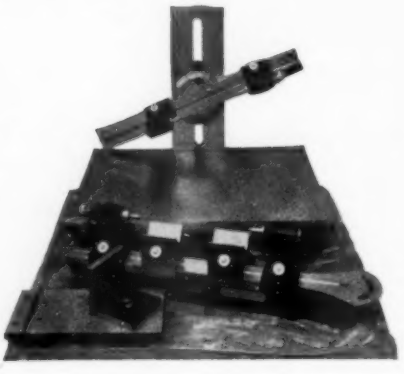

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Plaster Mold Casting of High Speed Impellers

By Herbert Brecht
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Asbestos-gloved worker above assembles pre-heated plaster core and permanent mold. Speed, deftness are required to prevent heat loss.

CASTING TO TOLERANCES as small as ±0.005 in. and surface finishes of 30 rms, once regarded as beyond the scope of practical foundry operations, is now being accomplished on a production basis at the Teterboro, New Jersey, foundries of Eclipse-Pioneer Division, Bendix Aviation Corporation. Positive control of dimensions and surface finishes, eliminating or heavily reducing subsequent machining operations, is made possible through a process of plaster mold casting, applicable to most non-ferrous metals.

By means of this method, developed after six years of experiment and research by Eclipse-Pioneer metallurgists and foundry engineers, intricately designed cylindrical shapes, such as high-speed shrouded impellers with complex inner construction, can be cast in one piece.

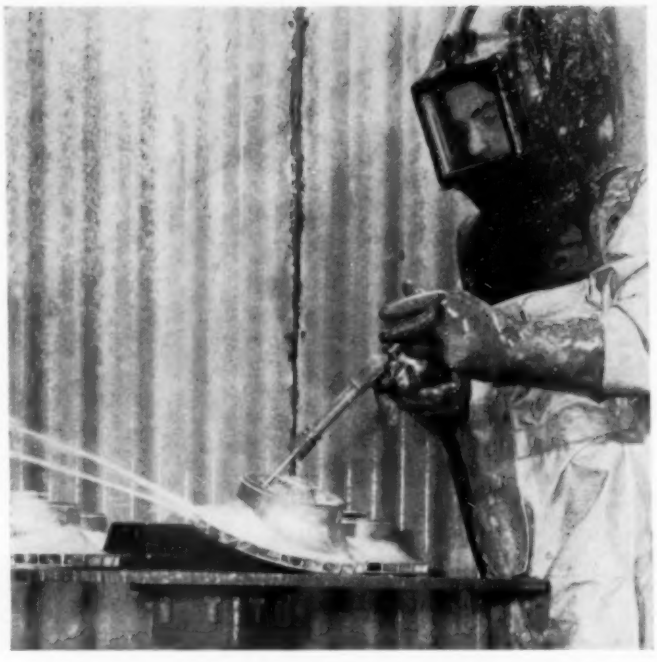
Plaster mold casting, like sand casting, employs the usual combination of molds and cores. In principle the two are the same: a mold forms the outer shape of the piece being fabricated while cores are used to block off inrushing metal so as to form internal passages and surfaces. In the Bendix plaster mold technique, however, the making of cores is a more complicated procedure than its counterpart in sand. It involves the use of cores within cores in a sequence of steps which makes it possible to produce in the ultimate one-piece casting, not only external, but internal surface as well, with satin-like smoothness, and dimensions to machine tool accuracy. Due to the ability to cast cylindrical pieces of large dimensions, the technique is finding a field beyond the dimensional limitations of the old "lost wax" process. Impellers 35 inches in diameter and weighing more than 200 pounds have been successfully cast at Eclipse-Pioneer, and the foundry is in steady production of castings of all sizes up to 18 inches in diameter. A 10½-inch impeller weighing 7.8 pounds is being cast in Eclipsaloy 322A (Alcoa 355) with a tensile strength of 35,000 pounds and yield strength of 25,000 pounds. It will withstand spin tests of 50,000 rpm and peripheral speeds up to 1732 feet per second peripheral speed to establish new standards.

Two sections of core box are separated after plaster has set. A threaded pilot forces out hardened plaster cast containing expandable vanes.

The step-by-step fabrication of a high-speed, shrouded impeller, with its intricate web of inner vanes, is a good example of the application of the plaster mold technique. First operation in the making of the impeller is the forming of expendable vanes to be used as cores in the plaster mold which will itself serve as core in the final casting operation. These vanes are then assembled in proper sequence in a cylindrical metal core box constructed, as are all tools used in this process, to rigid tolerances. A parting agent of lard oil and carbon tetrachloride is applied to the surfaces. A mating cover is placed over the box and locked in position and the whole unit inverted in preparation for the "pouring" of the plaster.

Plaster used in the process is subject to considerable care in blending and treating to insure accurate reproduction. Mixing the ingredients is controlled: A powerful rotary agitator, looking much like a large scale model of the milk-shake beater so familiar at soda fountains, automatically seals the container holding the mix. A motor driven vacuum pump then extracts the air to prevent the formation of bubbles during the operation, and whirring beater blades thoroughly churn the contents, under vacuum, to the proper consistency.

The mixture is immediately poured into an injection cylinder which is then attached to the mouth of the waiting core box. A hydraulically-powered piston forces the plaster up into the inverted unit with a strong steady pressure that distributes the mixture evenly around the expendable vanes and into every corner. The purpose of inverting the mold for this operation is an important one. If the plaster were poured in from the top it might envelop and trap bubbles of air as it tumbled through the pouring mouth, bubbles which would weaken the plaster casting and cause distortion and loss of dimensional accuracy in the final metal



Plaster core is removed with high pressure water jet which breaks up plaster and forces it from inner sections of casting.

casting. However, forced in from the bottom the mixture rises evenly and unbroken, while the displaced air leaks out at the top through joints and holes too small to permit the plaster mix to pass. The core box is then righted and, after the plaster has been allowed to set long enough to permit handling of the core, the two halves of the box are separated and a threaded pilot shaft forces the plaster casting, containing the expendable vanes as cores, out of the upper half of the box.

Tools and molds used in the fabrication of plaster castings must be kept scrupulously clean throughout all the operations. After each use they are thoroughly washed to remove any particles of plaster which might adhere to the surface. Since much of the work involves tolerances in the thousandths, these tiny bits of caked plaster could cause sufficient surface imperfection to cause rejection.

Removed from the core box, the plaster core is taken to the cleaning bench where the expendable vanes are removed. The core is then critically inspected for air holes, cracks, scratches, rough spots or other imperfections. Flash marks are removed and sharp edges turned by hand. Special gages check the various radii and dimensions, and all must fall within the prescribed tolerances.

Curing of the plaster core is the next step in the process. In a huge oven which maintains a constant temperature of 475 deg F the core is baked for a specific length of time, strengthening it sufficiently to resist distortion forces exerted by the molten metal and removing all moisture from the innermost sections. During this time, the permanent mold into which the plaster core will later be placed is also being prepared for the assembly of mold and core. After several hours in a 700 deg F oven the mold is taken out, the plaster core fresh from the baking oven is slipped into its place in the mold, a china clay parting agent is applied, and the assembled unit returned to the oven for approximately 30 minutes at the same temperature.

Ready for pouring, the mold is removed from the oven on an electric hoist and lowered onto a motor-driven spinner, the speed of which is determined by design of the casting being poured. In the case of the impeller under discussion the speed is about 350 rpm. With the mold in position on the spinner, a special sprue is fitted into the pouring neck to meter the flow of the molten metal. The restricting action of the calibrated throat in the sprue controls the flow of metal and insures a sounder casting and a minimum of oxide formation. Moreover, care is taken during the pouring to avoid unnecessary agitation of the metal in handling. The ladle is held close to the sprue to minimize the trapping of air, and the stream of metal is unbroken from the start to the finish of the pour. The spinning of the turntable creates a centrifugal force which helps distribute the molten metal to all parts of the mold.

Sufficient time is allowed for solidification of the metal before the mold is removed from the spinner. It is then placed on a knock-out bench and the casting, with the plaster core inside, removed from the mold. Cooled to room temperature, the casting is immersed in a soaking tank, usually containing hot water, where it remains overnight to soften the plaster core. Removal of the plaster is accomplished by means of high-pressure water blast. A fine stream of water directed into the casting passages under a pressure of 280 psi breaks up the plaster and drives it out of the inner sections. The casting is then rinsed in a tank of water at about 170 deg F to remove any plaster residue which might be clinging to the surface pores.

Conventional methods of heat treat are used to improve physical properties in castings produced by the plaster mold process. After first undergoing a critical inspection, both visual and by means of X-ray, the impeller casting is placed on a lathe for the removal of flash marks and is then transferred to the heat treat oven. Ten hours at 940 deg F produces specific characteristics in the metal, whereupon the piece is removed and installed on an air quench fixture. This air quench process is so conducted that cooling of the inner portions of the impeller is accelerated to match the rate of temperature drop in the outer portions and thereby prevent the distortion which uneven cooling would cause.

An aging action, aimed at increasing the tensile strength, yield strength and hardness of the metal, is the final step of the heat treat process. Aging, or weathering, could be conducted by exposing the casting to the elements for long periods of time. Daily changes in temperature, caused by sun, rain and other factors of the weather, would produce small contractions and expansions in the metal sufficient to relieve any internal stresses left by the first heat treat step. However, in the interest of time, heat is introduced as a catalyst in the aging process. Placed in an electric oven for 7 hours at a temperature of 280 deg F, the impeller emerges fully aged and ready for use. A final inspection is made, and, if passed, the part is then shipped.

The high speed impeller described in the foregoing paragraphs was selected as an example of the type of work possible with the Bendix technique of plaster mold casting but it should be understood that the process is not limited to this sort of application. Other types of non-ferrous castings, many less complicated in structure and design, are rolling from the foundry floor daily. A guide wheel for use in a torque converter unit was formerly produced by individually casting the various elements of the unit and then joining these in a final assembly operation. By means of the plaster mold casting process it is now cast as a single piece, thereby assuring proper spacing of the vanes and uniformity of air passages. Moreover, an impeller so constructed is inherently in balance, with the result that a costly machining process is thereby eliminated.

The plaster process more than fulfilled the stringent requirements of a 10-inch diffuser vane on which no imperfections or irregularities in the surface were permissible, while on a 10-inch airplane landing wheel a two pound weight saving was effected without any sacrifice of strength. The reduction was attained by the plaster mold casting of thinner walls reinforced by internal ribbing, and dimensional control is such that no machining is required on the tire mounting rim.

Establishing Punch Press Die Standards

By E. Griffiths
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DIE CONSTRUCTION standardization is practiced in varying degrees by all builders and users of dies. However, much can be done both in adding to and refining existing data. While it is quite true that texts contain valuable information of this nature, it is of necessity general, and a great deal of research is necessary to obtain related data covering kinds of materials, heat treatments, physical properties, size standards, size tolerances, size fits, and clearance between punch, to name a few.

Accordingly, Westinghouse engineers have undertaken the task of coordinating their company's die design and construction interests throughout more than twenty divisions in widely separated parts of the country.

The need for a standardization program is evident when the economics of the problem are considered from the viewpoint of the total investment in dies, and the possibilities of savings through the combination of the best features of varying designs. With more than 47 types of dies (Table I) among the divisions cited, and some 20 x 8 variables in addition, the situation becomes one first of correlation, and then standardization.

Our approach to the problem was to first accurately survey the types of dies in use in the company, after which a study of the many variables could be made. To do this, consideration was given to the following factors:

(a) There are forty-seven types of metal stamping and forming dies in use.

(b) Each specific application may require any one of many combinations of items shown in Table II, properly analyzed with respect to: Surface finish, tolerances on dimensions, kind of fits used, range of sizes, physical properties of material, material hardness, kind of material.

(c) Material thus gathered will be correlated on master sheets for review and recommendation by the Die committee.

Present status of the study is in the data-gathering stage, with final returns expected shortly. Questionnaires have been sent to all divisions requesting data on the types of dies listed, or others which might be of a special nature. It is appreciated that accomplishment of the plan will require certain attempts at standardization of nomenclature, as well as kind of material, hardness, clearances and tolerances. Final plans will result in central control of design features, and in addition to the obvious advantages, will facilitate exchange of production information on new materials, design and other factors.

Table I—Types of Dies Currently in Use

Benders
Blanking die—Compound type
Blanking die—Inverted type
Blanking die—Simple type
Bumping dies
Compound dies—Poles
Compound dies—Rotors or stators
Compound dies—Segment
Compound dies—Spider
Closed blanker—Segment
Cold press dies
Curling dies
Cutoff and heading dies—for rivets
Draw dies
Draw dies—Blank and draw
Embossing dies
Forming dies—Embossing
Flattening dies
Flanging dies—Flange or size for drawn blanks
Group slot dies—For poles or laminations
Heating element dies—Notching or slotting types
Hub forming dies
Knockout dies
Lancing dies—Slit and bend type
Louver dies—Slit and bend type
Marking dies
Notching dies
Open blanker—Segment
Partial blanker—Fingers
Partial blanker—"L" plate punchings
Piercing dies
Piercing dies—Rotor or stator
Piercing dies—Vent and rivet hole type
Pierce and blank dies—Progressive dies
Pierce and cutoff dies—Progressive dies
Pierce and notch dies—Progressive dies
Pierce and sever dies—Progressive dies
Round hole dies
Shaving dies
Sizing dies—For bent shapes
Slot dies—Radial index and ratchet rings
Slide feed dies—Progressive type
Slit and bend
Spider index—Pierce and trim type
Stencil dies
Stippling dies
Swaging dies—Or pierce and swage
Trimming dies—For forgings
Trimming dies—For drawn shapes
Trimming dies—For hot or cold press pierces and die castings
Trimming dies—Inside or outside diameter for rotor or stator

Table II—Factors Analyzed in Combination with Die Chart

1. Top shoe
2. Bottom shoe
3. Punch
4. Die
5. Blankholder or hold down
6. Knocker pin
7. Cap
8. Gages
9. Gage pin
10. Mandrel
11. Mandrel handle
12. Spacer for former stripper
13. Stripper springs
14. Stop blocks
15. Guide pins
16. Bushings
17. Solid die
18. Built up dies (Ground)
19. Built up dies (Not ground)
20. Punches (Ground)
21. Punches (Not ground)
22. Backing plates
23. Collar punches
24. Gib bars
25. Finger tips
26. Push stops
27. Auxiliary guide pin
28. Strippers
29. Die insert
30. Pilot pin
31. Swaging punch
32. Sever punch (Ground)
33. Sever punch (Not ground)
34. Bending punch
35. Cams—Machine operated
36. Cams—Hand operated
37. Spec. hex head screw
38. Forming punch
39. Ejector pin support
40. Clamp
41. Inside strippers
42. Outside strippers

Design of Fixture Elements

Rests, Stops and Locators

By Hans W. Smith

FIXTURES ARE used to machine the work or part in such a way that subsequently made parts will be the same within certain limits of accuracy. The fixtures discussed in this series are concerned with drilling, milling, forming, welding, and gaging. Their principles are explained by describing their elementary parts. Frequently, these parts can be used in any of these fixtures.

Most fixtures have this in common; they require a solid support as rest for the work. The work must be located in a definite manner. It must be securely held against moving during the machining operation. The work must be exposed where it is to be machined. Fixtures must be strong enough to withstand stresses imposed during the operation.

At least three points are required to support a part. This is the most secure rest for a flat surface—better than a continuous flat surface, because resting on three points eliminates wobble. When the shape of the work would permit tipping it, additional rests should be employed. These can be made adjustable and run-up against the work resting on the three main points.

Fig. 1 shows three circular rest buttons, sufficient if the clamping pressure is exerted over these buttons, or inside the triangle formed by tangent lines to them. When the part is not solid enough against bending, clamping pressure must be exerted directly above the rests.

While the work is lying on the rests it can move only in this plane. It can move in two directions. To locate it in one direction we move it against two stops. After this it can move only in a direction parallel to the face of the two stops, and one more stop will locate it finally.

Rests and stops can be machined faces of the fixture, Fig. 2. It is better to have them made as separate blocks screwed on to machined faces of the fixture. They can be more accurately machined and located that way. Also, if warranted, they can be easily hardened and ground. For this type of rest carburized steel SAE 1020 is often used. When made from tool steel it is necessary to place all holes so that they do not come too close to each other and to the edges, to avoid cracks in hardening. Rest blocks are often round buttons with only one fastening screw. Locating blocks must be doweled where the looseness in the screw-holes would affect the location.

Locating Block Welded to Fixture

When a fixture is very simple or where no great accuracy is required, an inexpensive locating block can be made by welding it to the fixture and machining the locating surface. Stops can be machined directly on the fixture or made as separate pieces (Fig. 3) and screwed onto finished fixture surfaces. The latter type can be hardened and ground. (See Fig. 5.)

Frequently it is desirable to make a stop adjustable, as shown in Fig. 4. An inexpensive stop of this kind is provided by using the head of a setscrew.

In addition to the main support of the work in three places it is often necessary to add additional supports in

Beginning an extensive series of articles on the principles of jig and fixture design, with particular emphasis on the factors underlying design of fixture components.

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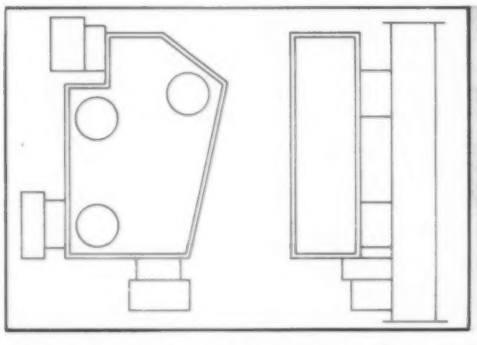


Fig. 1. These three rest buttons provide sufficient support if the clamping pressure is exerted over them or inside the triangle formed by lines tangent to them.

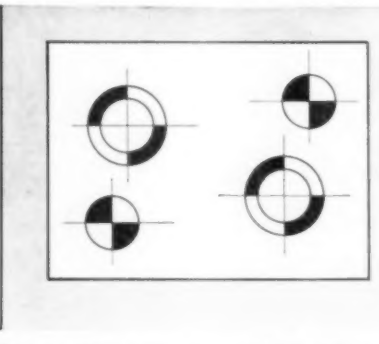


Fig. 2. Above rests are machined faces of the fixture. More effective results are obtained, however, when rests and stops are designed as separate blocks screwed on to the fixture.

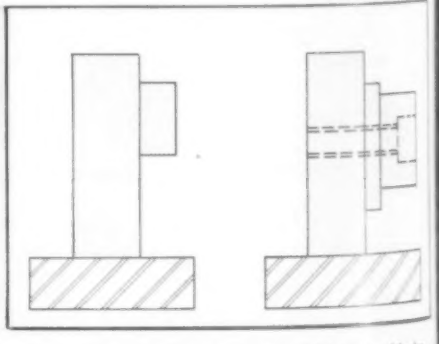
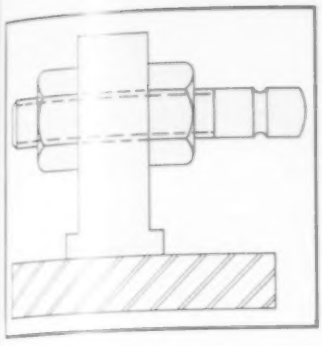
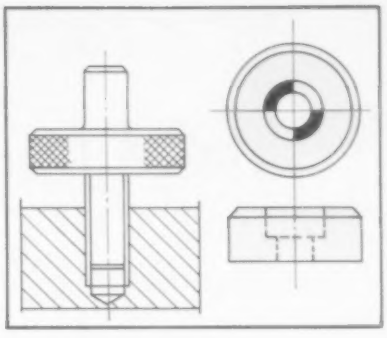


Fig. 3. Among possible designs of locating blocks are those made separately and fastened to the fixture (above), and others which can be welded to the fixture, with the locating surface machined.





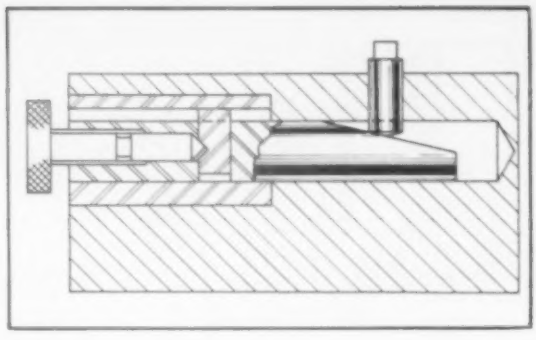
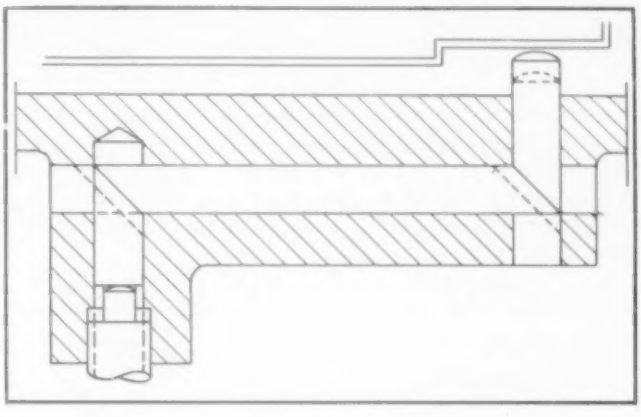


Fig. 4 (top left) illustrates an inexpensive adjustable stop produced by using the head of a setscrew. Fig. 5 (top center) provides a solution where additional support must be used. This adjustable support incorporates a jackscrew with a knurled shoulder which can be operated by hand. The wedge jack, shown in Fig. 6 (top right) is another method of providing additional support in hard-to-reach places. Fig. 7 (at right) illustrates a corner drive for a jackscrew for use where the added support can be reached only by turning one or several corners. Fig. 8 (right center) shows location procedure for a shaft. Shaft is placed in V-block; two dowels insure accuracy.



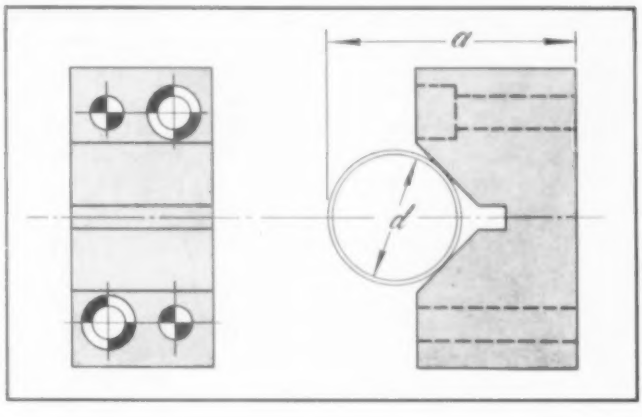
places where clamping pressure might bend the work or tip the work off the main rests. Such supports should be adjustable so that they will not spoil the proper rest of the work. A jackscrew (Fig. 5) with a knurled shoulder, to be run-up by hand suits such a case. Rests and locator faces are frequently made as separate pieces, so they can be hardened and ground. (See also Figs. 2 and 3.) A case-hardened button is shown here with the hole counterbored after carburizing, before hardening, thus insuring secure seating of the hold-down-screw.

Providing Additional Support

Another way of providing an additional rest that can be run-up against the work for support in a hard-to-reach spot is the wedge jack, shown in Fig. 6. The wedge slides in a bushing and the contact pin is brought up against the work by pushing the wedge inward. Turning the knurled handwheel moves pin inside the wedge, locking it in place in the bushing. Pushing the wedge by hand plus the small size of the handwheel prevent exertion of undue force.

Often an additional support for the work is required in a spot that can be reached only by turning one or several corners. Fig. 7 shows a corner drive for such a jackscrew. This drive cannot exert any force, which is the desired feature. After the work is unloaded the handscrew is turned to back away from the pin and the rest pin is pushed down by hand.

To locate a shaft, it is placed in a vee block as seen in Fig. 8. The block is made separate, hardened and ground, and screwed onto the fixture. Two dowels insure correct location. The vee is dimensioned by giving the height from top of shaft to bottom of vee and size of shaft.



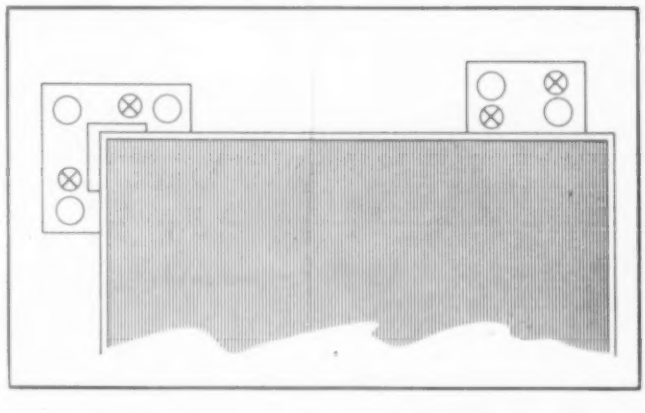
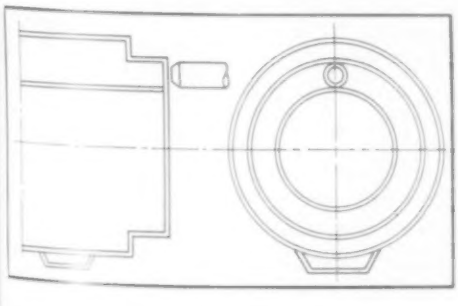
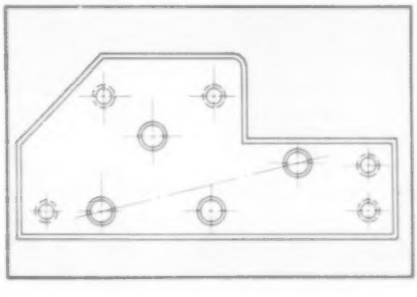
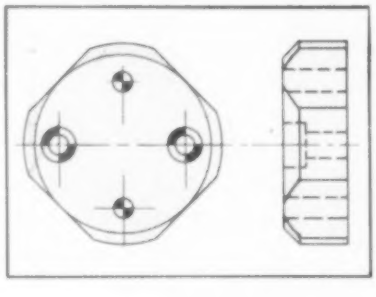


Fig. 9 (right) illustrates locating on sheared stock; placing locators away from corners is recommended. In locating on castings, avoidance of rough spots or parting lines is stressed. Fig. 10 (bottom left). As shown in Fig. 11 (bottom center), avoid tapped or elongated holes when locating in previously-drilled holes. Milling of sides (Fig. 12, bottom right) eases locator removal.







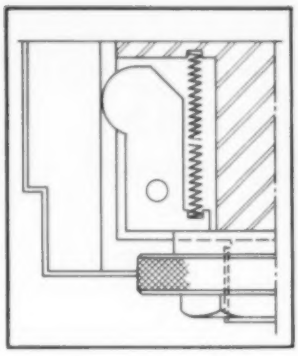


Fig. 13. Fingers on expanding locator are pivoted for uniform movement when handwheel is turned.

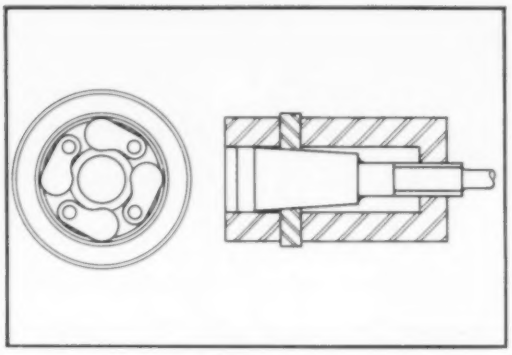


Fig. 14. Another type of expanding locator is shown above; the tapered shaft, when drawn back by turning the threaded end, moves four fingers uniformly outward.

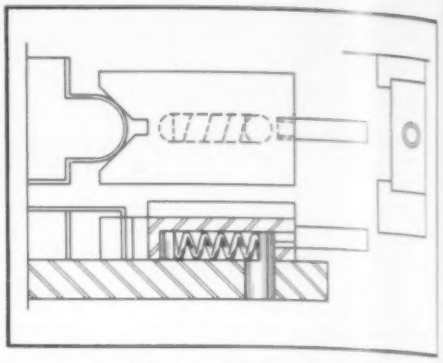


Fig. 15. The V-slide locator above is used for locating on a round boss. Design permits centering work in relation to boss, while slide permits necessary motion

A number of factors are involved in deciding where to place a locator; some of which are illustrated in Fig. 9 and following diagrams. When dealing with sheared stock it is well to stay away from the corners, as they may have burrs. In addition, the locators should be placed as far apart as possible.

When locating on the rough surface of a casting (Fig. 10), avoid locating on a parting line or the rough spots left from grinding-off risers or rough edges.

As shown in Fig. 11, when locating in previously drilled holes, avoid tapped holes. Use holes with maximum center distance. Avoid elongated holes. Use one round locating pin and one flattened pin for relief. Set flattened pin so that the relief faces the round pin. The flattened pin makes it easier to remove the work off the locating dowels, while nothing is lost in accuracy of location.

For medium and large size bores a close fitting locator should be relieved by milling off four sides (Fig. 12) which facilitates removing of work. The locating plug has beveled edges for easier loading.

Work which is fairly large and heavy and must be located from the holes, is sometimes difficult to get off the two locating pins, especially if close tolerances must be held. To make removal easier one locating pin can be made as a separate piece with a handle. Such a pin can always be removed by wringing, turning and pulling, and then there is only the one solid locating pin to contend with in unloading. The loose pin has a flat milled-on at the handle for identification marks, and a shoulder to insure proper setting. The handle is knurled to afford a good grip, and the pin is relieved in four places as described under Fig. 12.

The locator must be tapered when locating on a rough I.D. or O.D. to accommodate the variation in size that is to be expected. In this way the work will be located on its proper center regardless of its size. The expected variation of size determines the taper to be used. When locating in a bore, the plug is relieved as shown in Fig. 12.

An expanding type of locator for a rough bore of medium or large size is shown in Fig. 13 where fingers are pivoted so that they move uniformly outward when the knurled handwheel is turned. Three fingers would be sufficient to provide a positive grip, but four are generally used, since for measuring with a micrometer, the fingers must be opposite each other. Fig. 14 shows another type of expanding locator. The tapered shaft, when drawn back by turning on the threaded end, moves four fingers uniformly outward.

Equalizer Locates Varying Surfaces

A V-slide locator is often used when locating on a round boss. This will hold the work on center in relation to the boss, while the slide permits motion to accommodate any variation in the size of the boss (Fig. 15). A spring located inside pushes the slide always against the work. If a hole has to be drilled in the boss, the bushing plate is screwed onto the V-slide.

When a locator or a rest has to accommodate two rough or varying surfaces in such a manner that both work surfaces will be supported, a device known as an equalizer is used. (Fig. 16.) The one shown here is based on the principle of screw and nut. If a screw is kept from turning but permitted to slide longitudinally and the nut is turned, the nut will then run up on the screw until it meets resistance. After this, further turning of the nut will draw the screw towards the nut, until the screw meets resistance and both members lock. In Fig. 16 the tapered shoe at the left is part of the nut; the tapered shoe at the right is part of the screw, and is held between two crosspinned collars. This shoe, fitting over the screw where flats are milled on, keeps the screw from turning. When handwheel on left is turned, the rests move in under the work and support it.

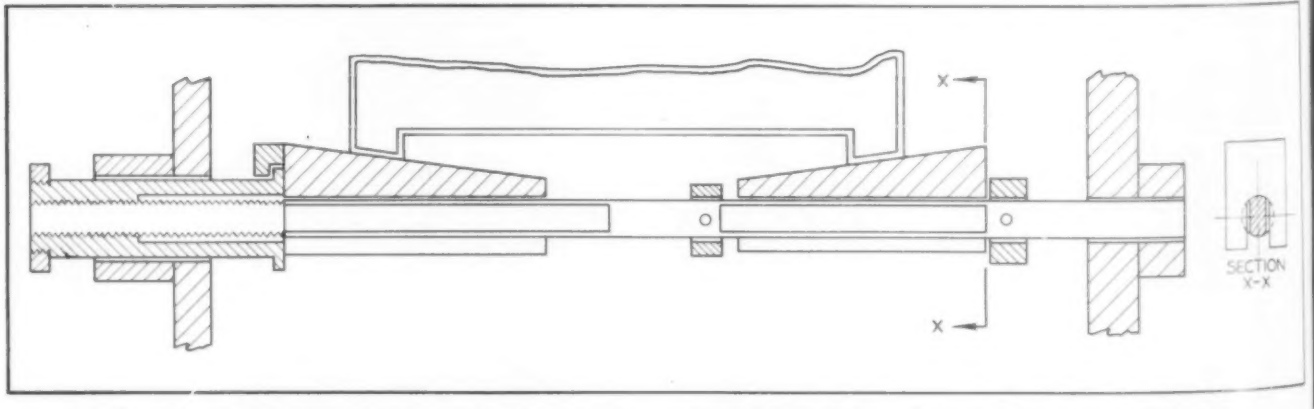


Fig. 16. This equalizer is used where rest or locator must accommodate two varying or rough surfaces so that both surfaces will be properly supported. Unit acts as screw and nut: resistance results when nut is turned on screw. Tapered shoe at left acts as nut; tapered shoe at right acts as screw, and is held by crosspinned collars. This shoe, fitting over screw where flats are milled on, keeps screw from turning. When handwheel is turned, tapered rests move in and support work regardless of variations.

Planning for Production

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THE PROCEDURE EMPLOYED in *planning for production* involves a multiplicity of related detail, so extensive that it often reaches the point of complexity. However, an orderly, progressive sequence of these details results in a solution to the problem, clarifying the entire picture.

Three methods may be employed to increase output of a given unit: build a new plant, convert a plant making a different product to the manufacture of the unit desired, or improve the efficiency of an existing plant. Generally the degree of complexity of the problem is in this same order; the first will require a higher degree of planning if modern methods and techniques are to be employed, instead of being a mere duplication of present facilities that may be outmoded and of reduced efficiency. The end result will be greater output and at reduced cost per unit.

We are concerned here with the direct factors influencing the manufacture of a product. Indirect factors (such as sales) will not be considered, although much of their success will depend upon how production is carried out. These direct factors include:

1. The production design
2. The operations to be performed
3. The selection and design of tools to be used on and with the machines
4. The machines to do the fabrication and assembly
5. The processes through the plant
6. The layout of the plant to house all of the above

The Production Design

Ideas and inventions improvise a *functional design*, created for a specific purpose. They are usually of flimsy construction (or the opposite, much too heavy), are subject to quite occasional breakdown, are of very expensive design and construction, and may have other faults too numerous to mention. Assuming that the idea is good, this *functional design* must be changed to the production design, which is *a design change to aid manufacture without affecting the original function.* In this change we are concerned with:

a. making a better product,
b. aiding manufacture,
c. introducing versatility of use, if a factor, and
d. reducing cost.

The production designer must know the many materials, machines and methods for fabrication. He must be able to visualize the successive stages of the sub-assembly and assembly processing, always re-examining his work to determine: is the original function being maintained; is there a more economical method than that being used; will the design permit ease of manufacture; have tolerances been carefully examined, realizing that closer-than-necessary work on a part increases cost of that part and its mating unit.

Therefore, it may be said that production design, correctly done, calls for the highest degree of manufacturing "know-how", ingenuity, and correlated thinking on the part of the production designer.

Direct Factors 2, 3, 4 and 5 in the first listing may be broken down and examined in the order which follows:

1. **Analyzing the product** (from drawings and specifications, or from a working production model), tabulate this information for each part:
   a. the sequence of operations for fabrication, or the "operations list";
   b. describe the operation in sufficient detail to be easily understood by those concerned;
   c. list the tooling selected for the operation, and;
   d. state the machine to be used.

Next in order is:

2. **The tool analysis** of:
   a. jigs and fixtures,
   b. cutting tools,
   c. additional small tools and assembly fixtures,
   d. inspection and measuring devices, or gages,

for each part to be manufactured. The decisions made in this tool analysis call for far greater detail than in number 1, the operations list. Actual designs, taking into account the desired output and thereby influencing the nature of the tool design, are introduced at this point. Not too much detail can here be included relative to the assembly fixtures, until an analysis of the processing is made, which is to be discussed later. However, these holding devices and assembly fixtures are a part of the tool design.

Following the tool analysis comes:

3. **The machine analysis,** which is a complete list of equipment needed for:
   a. fabrication
   b. assembly, and
   c. handling of work in process, transporting materials, units, subassemblies and assemblies.

Many choices may be available here, but it seems that a certain job is "a natural" for a particular machine and its associated tooling. Other methods, however, should not be overlooked. Production requirements necessitate the proper choice of the machine and its associated attachments, based on and in conjunction with the tool design.

This will be followed by:

4. **The routing analysis,** a study to:
   a. correlate sub-assembly and final assembly processing with the previous selection of machines and tools which fabricate the parts;
   b. facilitate a change to graphic form (block diagram) to more adequately show these successive stages in processing through fabrication, subassembly, and final assembly.

This is an extremely important part of production plan-

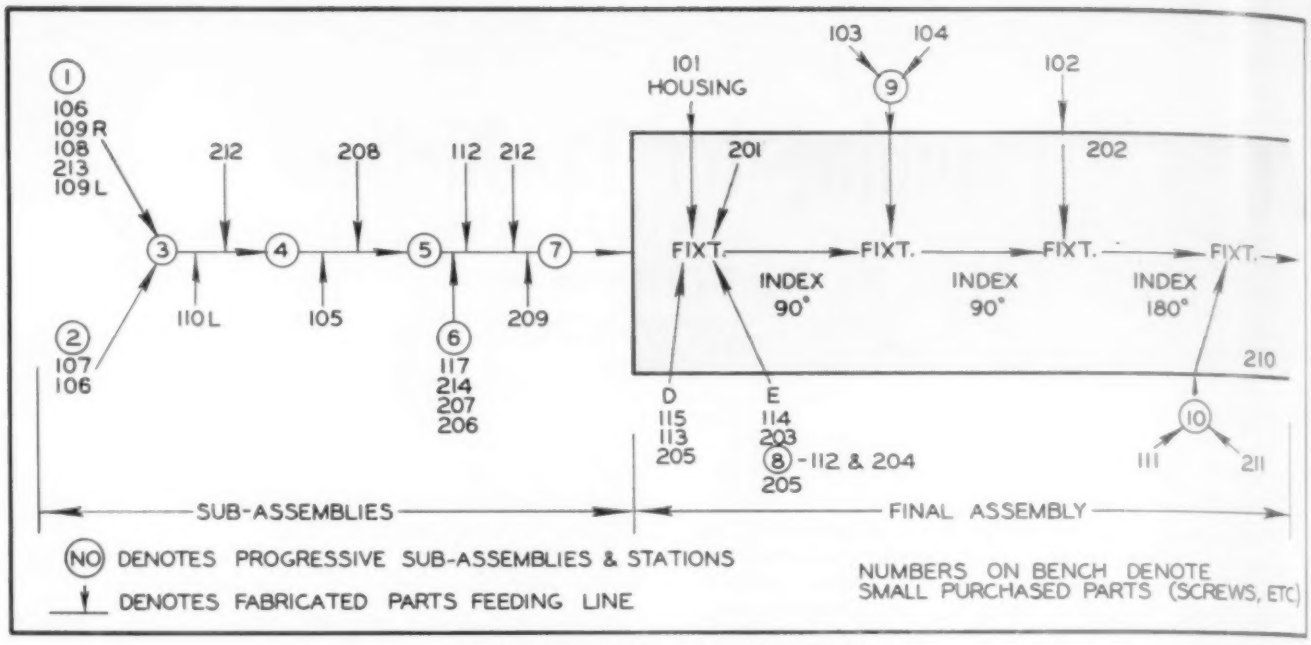

Fig. 1. Hypothetical plan of assembly production.

ning. A careful study must be made to determine the exact order in which the separate parts go together. Let us assume that this progression for a particular job has been worked out in the manner shown in Fig. 1.

It is readily apparent that the positioning of fabrication units to feed this line should be based upon this desired sequence, and therefore be in relatively close proximity. Exceptions to this would be made for those machines and processes in which such factors as high noise level, obnoxious fumes (heat treating baths) or safety considerations make it imperative that they be placed at suitable distances from the line.

If certain fabrication operations require more space than others for the machines, the line may change direction to allow for the needed area. This may also be necessary to adapt it to the building being used.

It should be understood that this block diagram is *not* the plant layout, because there are other items yet to consider. One of these is:

5. **The storage analysis.** Areas necessary for:
   a. raw stock and materials in storage before use and at the machines,
   b. work in process at the machines and on the lines, and
   c. the finished product.

Here the problem of handling devices begins to come into the picture to a large degree. The nature of the work, amount processed at a fixed location—coming to the work-point in large or small lots, brings in a study of materials handling equipment. This is an extensive study in itself, and as such should be treated in a separate article. We shall assume, therefore, that this selection is adequate for the job, and that space requirements have been determined for this part of the equipment, which will enable the next stage of planning to begin.

6. **The equipment layout** (sketches, templets, and final drawings).
   a. Floor area, projection area, and height requirements of each unit of equipment, to use in two dimensional templet form, or as a three dimensional model, in order to
   b. position to conform to the routing analysis, for correct machine and operator locations, and
   c. aid in the placement of materials handling equipment for movement of materials and product.

All previous studies have been made to aid in this layout of the fabrication and assembly section of the plant. Additional points to consider in new buildings, or as inclusions to existing plants, are next considered because they are a part of the whole picture.

7. **The building layout,** in sketches and final drawings, to care for:
   a. all previously specified areas,
   b. offices, receiving and shipping, engineering, research, tests, heating, toilets, lockers, toolrooms, cafeterias, recreation, lighting, power requirements, maintenance, plant protection and others.
8. **External plant analysis.** The last stage in the physical layout consists of a study of the external plant, in determination of the need for:
   a. parking facilities,
   b. service (roadways, railways),
   c. access to water, sewer, etc.,
   d. need for detached buildings,
   e. possible expansion,
   f. and others.

Additional points which should not be overlooked, and which will require space in the plant, are those concerned with maintenance and the control of quality. An analysis should be made of the possible troubles, expendable tools and equipment, and a list of equipment to facilitate maintenance.

Relative to the physical aspects of quality control, the selection of suitable gaging equipment, means for comparison with standard gages, and timely usage at selected intervals along the fabrication and assembly lines will aid greatly in maintaining production design requirements, informing production of defects that may occur, and thereby arriving at a product of greater uniformity and improved quality.

It should be understood that this outlined sequence of *production* planning may vary somewhat from the order given. The physical aspects of the manufacturing units and processes only have been treated, omitting such considerations as time and methods studies which are very much a part of the necessary analyses, and are important enough to warrant separate and detailed consideration.

The problems of materials handling in particular warrant extensive study, since this is one of the few places where marked gains in output may be secured by the application of the correct principle and the selection of adequate standard and specialized equipment.

Pre-Finishing Surface Requirements for Formed Metal Products

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THE OVERALL OBJECT in working metals prior to finishing is to (1) shape the metal in the fewest possible number of press operations with (2) the least number of inter-stage annealings or normalizings. Part design, press selection and selection of material are important in achieving this ultimate aim. Physical properties of the metal must be considered for effective presswork and finishing; these include ductility, tenacity, shear strength and grain size. The relation of the latter to good finishing results is a frequently-overlooked factor.

Standards of surface finish on shaped and formed articles should be high if the product is to be economically plated or anodized with decorative finishes. Poor surfaces are excessively costly to polish or buff; in addition the finish obtained is generally unsatisfactory.

An average grain size of 0.035 mm to 0.045 mm is generally best for deep drawing metals. With the exception of aluminum, which shows somewhat less pronounced effects than brass or steel, larger grain size structures tend to create rough surfaces or even failures in deep drawing sequences. Too small an average grain size will present smooth surfaces after shaping, but ductility is lost.

It is not always appreciated that a different average grain size is necessary to secure best results with different methods of polishing. In respect to drawing and stamping, as distinct from polishing, the best results will vary with the thickness of the metal as to the required average grain size.

Directional properties or pronounced, preferred orientation of the crystals, causes rough surfaces. It is more troublesome with aluminum than with steel or brass; the latter has the least tendency. The correct grain orientation almost always results in favorable deep drawing properties. The directionality of aluminum is improved by cold-rolling; and if not carried too far, the process aids steel. Brass, to the contrary, is harmed by cold-rolling.

I. SURFACE CONDITIONS

A smooth surface draws easier and loads the tools less; the result is faster production, less energy, less galling or scoring, and less tool dressing. In addition to surface smoothness: a matte finish; certain metallic deposits; a film of continuous, adherent oxide; iron phosphate will achieve (1) less frictional resistance, due either to their lower coefficient of friction or their greater absorption of the drawing lubricant; (2) less tendency to weld (foul) to the tools; and (3) the prevention of contact between the tool and chemically clean metal. The resultant surface conditions will enable the production of higher quality ware at lower costs.

Fouling of drawing tools may cause rough surfaces on the shaped articles. It is due to the nature of the tools and inadequate lubrication, as well as the softness and surface characteristics of the metal. Certain metals tend to foul and load tools; nickel-silvers and aluminums are particularly noticeable in this respect.

To explain the tendency of nickel-silvers to foul tools, Egeberg and Promisel have advanced an hypothesis: "The formation of cracks at the surface of the walls of drawn shapes expose minute areas of chemically clean metal, which are forced into contact with the tools at very high pressures, thus providing ideal conditions for fouling to take place".

In support of the above contention, Jevons states: "A factor contributing to fouling needs to be considered. It has been observed that the tendency of some metals to foul tools is considerable heightened if drawing is carried out immediately after pickling. (oxide removal)—The presence of a thin oxide film on a chemically clean surface provides a useful hindrance to the production of fouling".

Aluminum: Following the thinking of the quoted authorities, it is believed that the creation of a thin, continuous oxide film on aluminum would achieve better drawability and surface improvements; the reasoning is as follows:

It has been experimentally proven that the temperatures created by deep drawing steel are in excess of 1750 deg F momentarily at localized areas. If we assume that the same conditions prevail with aluminum, then it may be that temperatures approximating the melting point (1215 deg F) of aluminum may be attained. Aluminum oxide, however, fuses at 3600 deg F, hence, a continuous film of oxide would form a refractory coating which may tend to resist fouling of the tools.

The presence of the discontinuous, loosely held and thin, atmospherically (air) created, oxide film is no great deterrent to the fouling tendency of aluminum. Both the electrolytically-created and chemically-generated oxide films, as opposed to the air-oxide film are (1) continuous and adherent (intergrown with the parent metal) and (2) the artificially-made oxide film is also considerably thicker than the normal oxide coat.

The electrolytic (anodic) oxide film is too costly to create, as compared to the chemically-generated film. The colorless and transparent oxide film, created by immersion for a few minutes at elevated temperatures in the chemical solution, has a thickness of about eight to ten times that of the air-formed oxide film.

Other approaches to lower final costs of shaped aluminum and brass articles include:

(1) Paper-protected stock. This has some advantage but has several disadvantages, such as the disposal of the paper and possibly increased insurance costs.

(2) Mill-embossed sheet with a range of surface designs.

(3) The use of a drop-stamp or hydraulic press to indent designs on soft metals.

The last two methods produce better appearances in shaped and formed aluminum wares; which, although luxurious in appeal, actually cost less to create than if the articles were made from plain stock. For example: a shaped (dome) cover, made of 2S embossed aluminum sheet, contained about one square foot of 0.032 in. thick metal, and was priced 3 cents higher than for conventional mill stock.

When the cover was made of the latter, the cost for buffing one side of it was 11 cents; after anodizing and "gold"-dyeing, the appearance lacked the lustre of gold plate.

In contrast, the cover formed from embossed sheet was not buffed, but was chemically polished at a cost of 6 cents, then anodized and "gold"-dyed. The result was a brilliance and uniformity which was equal in appearance to that of a gold plate. Therefore, a high quality ware was turned out, and for 2 cents less than for a "passable" product.

Brass: A wide variation of surface finishes are supplied by the mill. Bright annealed and pickled, or fully annealed, are the usual drawing stocks. In some cases, attempts have been made to market brass with an improved brightness and better stability, by addition of chromic acid or a dichromate salt to the pickling bath. But any chromic acid salts which remain on the stock may cause drawing and polishing difficulties, because of a tendency to pit the tools.

On occasions, brass may come with a slight waviness; this condition cannot be remedied by polishing.

Steel is prone to a surface defect: stretcher-strain markings which are wedge-shaped or patterned. These markings evidence themselves on occasions when steel is placed under strain. The tendency increases with higher carbon contents. These markings cannot be polished out, but can be avoided by roller-levelling, usually by the large fabricator, or temper-rolling at the sheet mill. These rolling operations are lengthwise, sidewise and diagonally.

In further reference to the treatment of sheet and strip steel to procure suitable drawing and forming properties:

(1) Pickled and close-annealed steel is the cheapest stock but its roughness and its tendency toward stretcher-strain marking is too great for purposes other than shallow stamping or mild forming and bending.

(2) Pickled, cold-rolled, close-annealed (cold-rolled after hot-rolling) steel has less thickness variation, and it is smoother than the first-named steel. It is suitable for all but deep draws. Normalizing, in place of annealing improves the surface.

(3) Normalized pickled, close-annealed, cold-rolled steel has better directionality, ductility, crystal structure and a smoother surface with less stretcher-strain-marking tendencies than either of the (1) and (2) above steels. It is preferred for severe shaping operations, and it responds better to polishing and plating operations.

Superior, or extra grade steel, is offered in addition to the above steels.

In order to avoid critical-strain-crystal-growth in steel, normalize (or cold-roll aluminum) to beyond the critical stage of elongation.

Along the same line of reasoning as advanced for surface treating aluminum prior to deep drawing; steel may be Bonderized or phosphatized. As practiced by the Germans, the phosphatizing treatment of steel almost always reduced the necessary number of draws per anneal. The Pressed Metal Institute says, "Phosphatizing may enable the use of hot-rolled steel in place of cold-rolled with savings".

On occasion steel is given a copper or lead deposit in order to improve the drawing quality. Of course, prior to any surface treatment, the steel must be clean and free of loose oxide and scale.

II. TOOL DESIGN DEFECTS AND OPERATIONAL PRECAUTIONS

Errors in metalworking operations and defects in tool design which cause difficulties in finishing are outlined in Table I, and are detailed below.

Burrs may be caused in blanking and piercing operations by:

(1) Too great a clearance between the punch and die.

(2) Unsharpened tools.

(3) Inadequate lubrication.

Insufficient clearance strains the tools and consumes power. The cutting action in blanking or piercing should take place through one-third of the metal and the remaining thickness should be sheared off.

Wrinkling may occur on that part of the wall of the shell which has not passed over the radius of the die. This defect is caused by the following conditions.

(1) Poor directionality of the grains.

(2) Some metals like aluminum have greater tendencies to wrinkle than brass.

(3) Non-circular blanks.

(4) Insufficient metal at the proper portions causes wrinkles in the final draw.

(5) Incorrect die design.

(6) Incorrect clearance between certain areas of the die and punch surfaces as well as between the die and pressure-plate.

(7) Too small a die radius.

(8) Inadequate lubrication increases drag and this makes it necessary to reduce pressure-plate loading.

(9) Too few draws.

Puckering may be produced on that part of the shell wall which has passed over the radius of the die. It is caused by:

(1) Excessive hardness of the stock.

(2) Insufficient ductility of the stock.

(3) Average grain size of stock too small.

(4) Non-slipperiness of the lubricant.

(5) And, paradoxically, the use of a slippery lubricant also may cause puckering, unless the tools are modified to deal with the increased flow of metal.

(6) Radius of die too large.

(7) Incorrect blank dimensions.

(8) Cups with rounded bottoms, and certain other shapes which depart from a cylindrical design.

By increasing the radius of the die, wrinkling is diminished. By decreasing the radius of the die, the tendency to pucker is lessened. With these stalemated requirements, it becomes necessary to compromise.

Aluminum and thin-gage metals tend to wrinkle, because the pressure-plate loading that is required to prevent wrinkling, often proves to be so high in pressure that if it were used the depth of the draw would be reduced or the metal would be torn. Industrial practice is to permit the formation of some wrinkling, then trim it off.

Wrinkles should be confined to unwanted sections and not allowed to extend the wall.

Coining operations are resorted to for "ironing" out unwanted wrinkles and puckers. In addition to the removal of wrinkles and puckers in a surprisingly effective manner, a drop-stamp or hydraulic press will finish-shape, size, sharpen corners and form ridges.

Zinc, lead, soft alloys and rubber are efficient tool materials in the above operations. An almost unlimited range of shallow designs or patterns may be reproduced in a drawn shape; even printed or picture pages can be indented at extremely low cost—this is particularly applicable to the soft grades of aluminum.

The indented aluminum shapes do not require abrasive polishing or buffing, if they are chemically polished prior to the anodic treatment. The latter processing not only costs less, but results in a brighter and more uniform appearance than conventional methods.

Tearing of shells at one place continuously, indicates:

(1) High spots on die and punch.

(2) Too little clearances in regions where the shape of the article creates a thickening of the metal at the corners, will cause torn shells.

(3) If the radius of the punch, especially in drawing aluminum, is too small metal is apt to tear in the vicinity of the contact with the radius.

(4) A drawing speed which is too high may cause the bottom to be torn out of the cup.

TABLE I: SUMMARY OF DRAWING DEFECTS AND THEIR CAUSES

	Poor Drawability	Reduces Production	Poor Polishing	Poor Plating or Anodizing Qualities	Wrinkling	Puckering	Rough Surfaces or Scoring or Galling	Tears Out Bottom of Cup	Tears Out Square Corners	Top or Bottom Corners Break	Fractures or Bursts	Crumbling	Excessive Barring	Loss in Ductility	Loss in Tenacity	Reduces Depth of Draw	Season Cracking (Brass)	Stretcher Strains (Steel)	Press or Tool Breakage	Strain (Age) Hardening	Abnormal Crystal Growth	Loose Oxide and Scale
Rough stock	√	√	√	√			√				√											
Stock too thin	√				√							√										
Thickness variation	√	√											√						√			
Grain size too small	√	√				√					√			√								
Grain size too large (Brass and steel)	√	√	√				√								√			√				
Grain directionality—Poor (Aluminum and steel)	√	√	√	√	√		√															
Poor tenacity	√	√				√	√				√											
Poor ductility or too hard	√	√				√																
Loose oxide or scale	√	√	√	√			√															
High carbon steel	√	√		√												√		√				
Low-copper-content brasses	√	√		√										√		√	√					
Chemical impurities	√	√		√										√			√	√				
Season cracking (Brass)			√	√																		
Stretcher strains (Steel)			√	√																		
Strain (age) hardening	√													√		√		√				
Abnormal crystal growth	√		√	√			√				√				√							
Stress cracking	√													√		√		√				
Dull blanking tools													√									
Die corners too sharp										√												
Die radius too small					√		√	√	√													
Die radius too large						√																
Punch and die clearance—small					√			√														
High spots on tools		√					√	√														
Water or air in die							√															
Pressure-plate pressure too high		√			√						√					√						
Pressure-plate pressure too low						√																
Drawing speed too high			√	√			√	√														
Too few draws					√						√											
Fouling and loading of tools		√					√															
Die or punch design incorrect	√	√			√	√		√			√		√									
Not enough metal for final draws					√						√											
Incorrect blank and round bottom cup dimensions						√																
Incorrect knockout	shell bulges																					
Annealing temperature too high too longer cooling, too slow	√		√	√			√				√				√						√	
Poor lubrication	√	√	√	√	√	√	√		√										√			
Failure to remove oil			√	√													√					
Faulty annealing and cooling	√	√	√				√							√		√	√		√			

Breaking or piercing of the shell (1) is due to, especially in the case of aluminum, too large a punch radius.

(2) Breaks at the top or bottom corners indicate that the corners are either too sharp or have too small a radius. This may be checked as a cause by releasing the pressure on the blank-holder slowly; if this corrects the defect, then it is certain the die must be reradiused.

(3) If the bottom of the shell breaks out, it may be due to insufficient drawing radius in relation to the blank diameter. This condition will give a clearance between the punch and die which creates excessive pressure of the blank-holder, and excessive friction between the holder and die necessitates better die material.

Burst shells may be caused by: (1) Inadequate tool clearance, or excessive grip on the pressure-plate may cause the drawn article to burst. (2) The incorrect physical condition of the metal. (3) Too small an average grain size.

Fractured shells may result from: (1) Excessive friction which is caused by scored and roughened radius of draw rings. (2) Loose oxide or scale on stock. (3) When two or more draws are required, insufficient metal at the proper portions may create fractures in the final draw.

Uneven length of drawn shells may be the result of the blanking-ring not being concentric with the draw die. Other causes might include the blank-holder bearing harder on one side, or a badly burred blank causing holding on one side.

Bulged shells may be due to an incorrect knock-out design.

Scoring may be due to many conditions such as (1) Loaded tools. (2) Dirty stock or lubricants. (3) Inadequate lubricants. (4) Water or air in die. (5) Poorly polished die and punch. (6) Incorrect die or punch material. (7) Too high a drawing speed.

Clearances: Usually there is some clearance allowed between the punch and die, dependent on alloy and thickness of stock. As a rule, the clearance allowances are: 0.05, 0.06, 0.07, and 0.14 percents of the thickness of mild steel, high-carbon steel, brass and aluminum, respectively. Clearances can be very closely related to the shearing strength of the stock.

Radius of draw die and punch: Aluminum is more sensitive to the radius of the draw die and even more so to the radius of the punch than other metals. When drawing aluminum the conventional punch radius is given a bevelled 45 deg face of some width and with suitable radiused corners.

III. LUBRICATION

In addition to faulty tools and the peculiarity of certain metals, inadequate lubrication causes fouling or loading of tools. In spite of the first two factors, tools would not foul

if a continuous film of the correct lubricant could be maintained between them and the stock.

The lubricant must have certain basic characteristics as listed.

(1) **The viscosity** should be high enough to maintain a film at elevated temperatures as may occur at localized areas in deep drawing. Mineral and castor oils and sodium-base soaps have this property.

(2) **Adsorption value:** Only lubricants with unsatisfied atomic linkages can be truly adsorbed by the metal surfaces. Ordinary mineral oils do not possess this property, as do chlorinated or sulphurized mineral oils, animal, vegetable and fatty acid oils. The treated mineral oils should not be used on metal which is to be annealed.

(3) **High film strength** is a useful property. Tallow, animal fat, and metallic soaps (calcium, sodium, lead), sulphurized mineral oil, lard, palm and oleic oils have this attribute.

(4) **Slipperiness** is possessed by castor oil, graphite, mica and the oxides of certain metals. A combination of castor and mineral oils has sufficient value.

(5) **Spreading** or healing power is also a requirement.

(6) **Adhesion** is a factor apart from adsorption.

(7) **Stability:** Certain animal and fatty-acid oils may require benzoic acid preservation to prevent rancidity.

(8) **Ease of removal** is a paramount necessity. Lubricants must be removed prior to annealing, normalizing or "ovening"; otherwise carbonized particles will become embedded in the metal.

Mineral oils must be removed in mineral spirits or trichlorethylene; or by emulsification, followed by a steam or hot water spray. Animal and vegetable oils require saponification. Mixtures of mineral oils and saponifiable oils, provided the mineral oil content is not too high, may be removed by saponification.

Mechanical entrapment of drawing compounds in the pores of the metal is difficult to remove.

In the removal of lubricants by saponification, sodium carbonate, sodium metasilicate or trisodium phosphate are preferred over the stronger caustic soda, as the latter is more difficult to rinse. Any one of the above salts or a combination thereof, together with emulsifying and wetting agents will present a good cleaning solution at elevated temperatures.

Rinsing after cleaning is of equal importance, and a running water rinse in itself is not efficient—a power spray should also be in the cleaning cycle.

In addition to the troubles occurring to the finishes, due to failure to remove drawing lubricants, season-cracking of brass may be promoted by oil which remains too long.

Lime-base soap will stain aluminum and zinc. Sulphur oils may stain brass if not quickly removed.

Lubricants for aluminum: 30 and 70 percents of mutton tallow and paraffin is recommended for very severe draws. Half and half of each (or heavy cylinder oil) will suffice for severe draws. Kerosene will meet the needs of light drawing operations or medium lubricating oil for medium draws.

Lubricants for brass: Soap and water solutions serve for most of the drawing oil removal sequences.

Lubricants for steel: 25-25-50 mixture of graphite, beef tallow and lard oil is an excellent lubricant, but may be difficult to remove. Dry white lead or lard is useful for heavy draws. Moderately severe operations can be made with 5-25-45-25 percents respectively of sodium soap, castor oil, chalk and water. This latter is easily removed.

A sheet stock with a low shearing strength requires a heavier lubricant in blanking and piercing operations than stock with high shearing strength.

IV. ANNEALING, NORMALIZING AND PICKLING

During deep drawing, a stage is reached at which the metal is work hardened to such an extent that ductibility is inadequate for further plastic deformation, and must be restored. Annealing restores ductility and this implies recrystallization.

Aluminum: The annealing or recrystallization ranges of different metals and alloys are as follows: aluminum 2S and 52S is 620 deg F and 3S about 750 deg F for a short period. The cooling rate is not important. The heat-treatable alloys are also annealed within those ranges. The solution heat treatment range is 870 deg F to 970 deg F., dependent on alloy and the temper desired. Precipitation heat treatment range is 250 deg F to 450 deg F., temperature and time is dependent on alloy and thickness of metal as well as the temper desired. The cooling rate in annealing heat-treatable alloys is about 50 deg F per hour down to 500 deg F, after which the cooling rate is not important.

Brass: is generally purchased in the fully-annealed condition for deep drawing purposes, and usually requires interstage annealing on all but the less severe drawing operations.

Brass is annealed at the range of around 1030 deg F; the cooling should not be too fast. Brass and steel are subject to stress-cracking, to relieve the stresses, anneal at 480 deg F to 660 deg F for about one-half hour. Stress-cracking occurs from permitting the deformed metal to stand too long prior to annealing.

Fire-cracking occurs on brasses with a high lead or iron content as a result of heating too rapidly. Over-annealing of brass produces rough surfaces, which is referred to as "necking."

Avoiding Abnormal Crystal Growth

Steel is annealed at over 1500 deg F. and cooled slowly. It is normalized at 1780 to 1740 deg F for a few minutes above its critical range, then it is cooled fairly fast in still air until it reaches approximately 1240 deg F, after which it is cooled slowly.

Bright annealing in a protective atmospheric furnace creates a surface which readily fouls tools.

Abnormal crystal growth or critical strain crystal growth results from (1) annealing at too high a temperature, or (2) too lengthy an annealing period or (3) cooling too slowly. This defect is attributed to unsuitable interstage annealing operations.

Abnormal crystal growth is more successfully avoided, in the case of steel, by normalizing rather than annealing. Some brasses are also subject to abnormal crystal growth. In either instance, whether annealing or normalizing is practiced, it is performed at beyond the "critical" range of elongation (5 to 20 percent elongation is the critical range).

A metal which is in a condition of abnormal crystal growth has a low tenacity and is apt to fracture at places where the growth occurs when further pressure is exerted.

Shallow shapes or at areas of shallow draw are more susceptible to critical-strain-crystal-growth. Low carbon steels tend to this defect to a greater degree than high carbon steels.

Pickling: Steel must be pickled after annealing or normalizing, unless the furnace is operated with a protective atmosphere.

The temperature of the pickling bath is more important than the acid concentration. The bath is generally a sulphuric acid solution and to a less frequent extent a hydrochloric acid solution. The pickling solution must include additives to inhibit localized attack and hydrogen embrittlement.

Drawing should be performed shortly after pickling, although if steel is shaped too soon after pickling, the absence of oxide may make it difficult to adhere the drawing lubricant to the chemically clean surface, and thus the tools become fouled.

Engineering Oil Seals to the Product

By R. S. Rainey

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THE STANDARD TYPE OIL seal is a relatively simple product which incorporates many variables controllable to develop a product adapted to a wide variety of conditions. Its physical dimensions can be changed to meet a multitude of conditions and, more important, its sealing qualities can be widely varied.

The most important factor in an oil seal is the sealing member proper. These flanges are made from leather and various types of synthetic rubbers. While leather has a considerable field of application, the development of the synthetic rubbers has opened a new field for the industry. Because rubber is more homogenous, with proper control each flange can be made like the last one. With leather the manufacturer is dependent upon a large number of natural conditions inherent to the product. Synthetic seals have lighter torque and provide a more flexible material for intricate shapes. Probably the only limitation of rubber compared to leather is that it requires lubrication at all times. Leather still has a field of usage in those applications such as wheels where starving of the seal area occurs.

I. MANUFACTURING VARIABLES

Among the many factors which have come under intense and remunerative study in bringing the unitary seal to its present state of efficiency and adaptability, the following are important:

1. Spring tension.
2. Shape of sealing member.
3. Amount of shaft interference.
4. Combinations of different materials in multiple.
5. Relations of speed, temperatures and pressures in combination with all other variables.

Other developments, of even greater importance, have included the following:

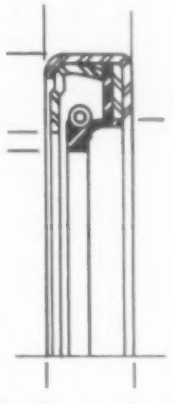
6. Ability to vary the sealing material for practically any industrial fluid;
7. Ability to adjust the hardness or durometer of the sealing member;
8. New synthetic sealing materials, and improved leather processes and tannages;
9. Advances in knowledge of the use of dual sealing members.

The result of all this is an increasing number of applications now employing some complex face type of seal (such as farm equipment, tractors, track thread units and other machinery working heavy dirt under adverse conditions) where a well designed shaft seal would give equal or better performance at far lower cost.

From a paper presented before the Golden Gate Chapter of ASTE.

II. TYPES OF SEALS

Shown in Fig. 1 is the single spring-loaded sealing member, metal encased, which represents at least 80 percent of all seals manufactured. This seal is made with leather, or with rubber or other synthetic sealing members. Leather is commonly used for low speeds, low temperatures, and heavy-duty machinery where finishes are not the best.



The general performance of the leather seal has been improved 30 to 40 percent over its performance of only a few years ago, as a result of recent developments in tannages, shapes of sealing members, methods of trimming, and in molding practices. This seal is now capable of operating continuously at temperatures over 200 deg F; can stand peripheral speeds up to 2000 fpm; and is capable of considerable life on machinery with shaft finishes as rough as 50 to 60 rms. Because it is made of relatively inert material, however, it does not have the runout ability of the more flexible synthetics.

Synthetic single member spring-loaded seals have benefitted from considerable development work in the last few years. Careful compounding of new synthetics has developed seals capable of continuous operation with zero leakage under temperatures of over 300 deg F, speeds of 3600 fpm, and with the ability to stand runout consistently as high as 0.030 indicator. The smooth surface of the synthetic is more sensitive to shaft surface than leather. However, common practice of using 15 to 20 rms turned shaft finish results in a seal life of several years.

Considering all angles, there is considerable inherent advantage in synthetic seals in that all factors of production—and especially the constancy of the sealing member—are controllable. These seals are generally specified on all high speed applications such as engines and pinions, transmission and gear drives of all sorts.

Spring-Loaded Flex Seal

Also of note in the spring loaded type of seal is the flex seal (Fig. 2). The added convolution in the flex section increases the ability of the seal to withstand runout, eccentricity whip, and other unusual operating conditions. This seal is used in many places, such as steering mechanisms, where wear on bearings must be anticipated; also in applications such as automotive rear wheels, where a considerable amount of shaft whip is expected. An added advantage of the seal is the rubber covered OD, which assures a seal on

Fig. 2

Fig. 3

Fig. 4

the OD. This can be designed in many different forms to clear bearings or surrounding mechanisms.

Further development of the flex seal is shown in Fig. 4. This seal is used where extreme wear and runout are involved, such as on steering equipment, and on heavy-duty equipment such as road graders, tractors and farm implements. Here the extra flex sections are held to the shaft with an auxiliary steel ring, which assures that the sealing member will follow the shaft regardless of the latter's contortions.

Springless Single Member Designs

Springless oil seals, single sealing members, made from leather and various synthetics, are used where complete sealing is not required and where slight leakage is not objectionable. Springless leather seals (Fig. 3) are often specified in applications where heavy grease is to be withheld and temperatures are low, and speeds do not exceed 1000 fpm.

The most versatile of the springless designs is the steel supported synthetic seal. Three different designs of this seal for specific applications are shown in Figs. 5, 6 and 7.

Generally speaking, all of these designs are superior to springless leather seals and are available for a wider range of applications. They retain lighter oils, and withstand greater temperatures and higher speeds.

The most common design of these springless synthetics is shown in Fig. 5. This type is often specified for wheel applications which are well designed and have good sealing surfaces. This seal is capable of medium pressure, but with slight redesigning can withstand pressures from 70 up to 100 psi.

The design illustrated in Fig. 6 is intended primarily for use where temperatures and speeds are high, but where eccentricity and runout are low and running parts are accurately made. This seal is limited, however, to not over 5 to 10 psi pressure and is a compromise seal when space limitations forbid using a spring-loaded type seal.

The seal shown in Fig. 7 is primarily a pressure seal. It has been operated successfully up to 600 psi fluctuating pressure, at minimum speeds. It is also suggested for extremely small cross-section of ID vs. OD, where a relief design is not possible. This seal is often used on shaft of $\frac{3}{8}$ in. diameter and below.

Lately we have been making a good many of our springless synthetic seals with a coating of rubber on the OD (Fig. 8). This design is useful in narrow sections and on relatively small OD's since it assures a leak-tight fit on the OD.

Fig. 5

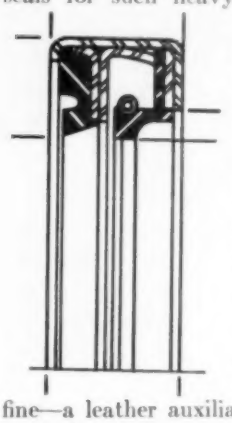
Fig. 6

Fig. 7

Fig. 8

Dual Member Seals

The dual member seal has replaced end and face type seals for such heavy-duty equipment as disc plows and track-type tractors. This seal (Fig. 9) effectively combines two rubber sealing members, one of which is spring loaded and the other springless.



Most common of the dual seals is a single spring loaded member of leather, or synthetic, with an auxiliary member produced in a wide range of materials. When speed is low and dirt conditions are very severe, this auxiliary often is made of rubber. At medium speeds with severe abrasive conditions—especially when the abrasive material is not too fine—a leather auxiliary member is used instead of rubber, with the main member being leather or rubber depending on conditions.

At relatively high speeds, with lighter abrasive conditions, such as automobile pinions or transmissions, a felt auxiliary member is used, with rubber used for the main member.

Other forms of dual seals include two spring loaded members pointing in opposite directions, made of either rubber or leather depending on speeds and temperatures, to separate two different industrial fluids; double sealing members, of either leather or synthetic, pointing in the same direction to withstand excessive pressures.

While dual seals possess definite advantages under specific conditions, they also have a number of limitations. These include the obvious fact that two rubbing surfaces heighten friction development in the sealing area. In this connection it will be realized that any oil seal is necessarily a compromise between loss to friction and perfect sealing, although development in late years has reduced the friction required to make an accurate seal. Another feature of dual seals which may add friction and heat is that one member is apt to be starved of lubricant by the other, more effective, member. An additional limitation is that, for perfect dirt exclusion, the auxiliary member generally is made of a porous material which tends to collect abrasives into itself. This, at times, may cause shaft wear, and it is often necessary to harden shafts where auxiliary members are used. Normally, oil seals of the newer low-friction synthetic type can operate almost indefinitely on soft shafting, if minimum abrasive is present, without shaft wear.

End or Face Type

The primary reason for the use of these relatively expensive seals is to reduce torque below even the low standards now available in the less expensive types of shaft seals.

The face seal inherently requires more parts, more careful designing and finish, careful study of the mating face under a specific set of operating conditions, and always requires more expensive arrangement and machining of the mechanisms where the seal is to be installed.

These seals are useful in pump applications where a wide range of industrial fluids is employed, and where the seal must have extremely low starting torque and must last for long periods without service. They have found application in torque converters, washing machines and similar uses. They have a further advantage in that they can be designed to withstand temperatures of 600 deg F and above.

Seals of special design fall into two categories, those with obvious special arrangements such as external flanges, shoulders, etc., and those which are specially designed internally and/or with regard to size and shape.

Special seals find use in applications where limitations as to area or other factors make it impossible to adapt seals of standard size, shapes or designs. For example, a manufac-

turer may find his unit with a stamping or other type of closure to which a sealing member is attached. In another case, a manufacturer may have an area so constricted as to prohibit the use of the regular round seal, bolted or pressed on, and require the application of specially shaped sealing members to clear his mechanism. In other cases, extreme flexure or extreme runout may be required, and one or more convolutions can be made in the sealing member to take care of the special needs.

III. OIL SEAL DESIGN

A study of speed and temperature is of importance when a new application is contemplated. This has become especially true in recent years since the higher shaft speeds and greater operating temperatures of modern mechanisms have intensified the problem of efficiently retaining lubricant around bearings. Today, designers and manufacturers often are called upon to supply oil seals for shaft speeds exceeding 8000 to 10,000 rpm. Even some automotive oil seals are required to withstand 5500 rpm with surrounding ambient conditions from 180 to 200 F.

In terms of peripheral speeds in feet-per-minute, 2000 to 2400 fpm was once considered the maximum. Today many applications operate with peripheral speeds ranging from 3500 to 4000 fpm. Shaft fpm of this nature becomes a governing factor, around which the available sealing materials must be balanced with the width of the sealing surface, surrounding temperatures, proximity to the bearing, and whip and runout conditions. Here is a useful rule of thumb for designers wishing to operate a seal at 3000 rpm or above: surrounding temperature not over 200 deg F; runout or eccentricity not over 0.010; shaft surfaces finished to not over 20 rms.

It is also desirable to avoid shaft whip and jump by mounting the seal close to the bearing; and for best results, the seal should be relieved so no pressure can build up in the bearing area. The ID-OD relationship of the seal itself should be sufficient for maximum cooling.

Advances in sealing knowledge and technology have provided seals which today offer performance capabilities far exceeding the foregoing requirements. In the field of leather seals, for example, improvements in impregnation methods have produced seals capable of extended operation at temperatures as high as 250 deg F, while synthetic rubber seals operate successfully at temperatures up to 325 deg F.

Eccentricity, Whip and Runout

Shaft eccentricity, misalignment, momentary whip and end play are conditions present in varying degrees wherever shafts turn. These conditions create basic oil sealing problems, but proper oil seal design will solve these problems and protect the bearings. Usually, when these conditions are severe, specially-designed spring loaded oil seals are indicated.

Tests over a period of years have indicated that properly designed synthetic rubber seals, with correct spring tensioning, will operate efficiently despite eccentricities reaching 0.030 indicator at 4000 rpm. Here it is most important that flexibility of the sealing member be carefully balanced with the proper spring tensioning. However, both life expectancy and degree of sealing suffer proportionately with the rise in eccentricity.

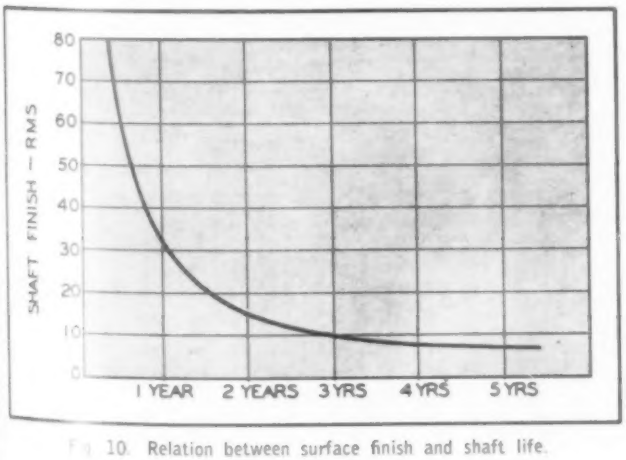


Fig. 10. Relation between surface finish and shaft life.

Actual misalignment of meeting parts in a design has a slightly different effect on oil seals than eccentricity. Utmost flexibility of the sealing member is essential, and again, special designs are recommended. Good sealing has been achieved on long test runs where misalignments are as high as 0.035 in. But surrounding conditions should be the best possible, and the seal so designed that it may operate efficiently in an off-center position.

The momentary whip or misalignment which occurs in flexible crank or drive shafts presents still another oil seal problem. Highly flexible oil seals, capable of efficient operation despite steady eccentricity or misalignment, sometimes allow seepage under severe momentary whip conditions. Special oil seal designs using heavier spring tensioning are indicated; but if tensioning is not precisely correct for the job, seal life will suffer.

Shaft end play can be compensated for in the oil seal design by stiffening the seal to avoid buckling the flange, and adjusting spring tension to overcome seepage during end-play movements. Here again, a special design of spring-loaded seal is recommended for maximum oil sealing efficiency.

In all the above cases, greater oil seals life and performance will result when conditions are held within the following limitations:

Eccentricity (runout)	Not over 0.005 in.
Misalignment	0.005 to 0.010 in.
Shaft End Play (thrust)	Not over 1/32 in.

Severe momentary whip can often be modified by placing oil seals close to bearings; using sufficient section in the shaftings, and increasing the number of bearings employed.

Correct Shaft Surfaces Essential

Oil seals perform best and last longest on shafts of maximum hardness and smoothest finishing. Seal performance depends on these two factors, when other conditions such as speed and temperatures are equal.

In many production applications, however, optimum hardness and smoothness may be impractical. Also, on many slow-speed, wide-tolerance mechanisms, a polished shaft may not be necessary or desirable.

Tests conducted over many years' time have shown RMS finishes of between 15 to 25 to be a practical compromise for most industrial applications. Such a finish can generally be obtained by production methods without prohibitive cost. During tests, seals on shafts on this finish have operated continuously up to 12,000 hours at high speed without evidence of serious leakage.

More finely finished shafts, of course, permit still greater seal performance. On test shafts polished to 5 rms, the seals have been continuously operated at 4000 rpm for several years—many times the life expectancy of any mechanical equipment. On shafts finished only to 150 rms, operating at 4000 rpm, similar seals may have a life expectancy of as little as a few months, or even weeks. A rough relationship of shaft finishes to seal life is shown in Fig. 10.

Under ideal conditions, where shaft speeds are slow, where oil is properly filtered and dust excluded, seals will operate almost indefinitely on shafts of cold rolled steel.

In many cases some abrasive material is turned into the sealing area. Shafts therefore should be of a hardness (at least locally) compatible with severity of the abrasion present. Under severe conditions of abrasion, both the seal area and bearing area should be hardened locally.

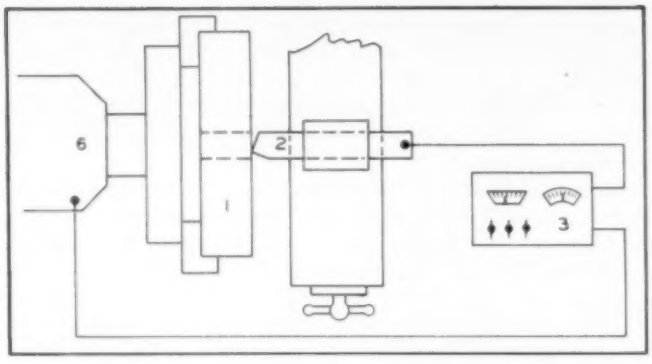


Fig. 1. Schematic diagram of arrangement of test on lathe.

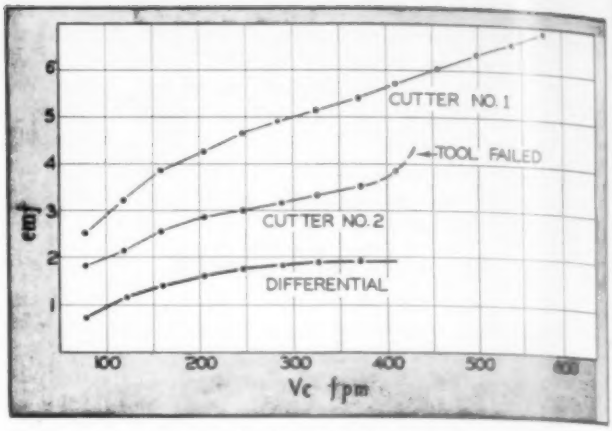


Fig. 2. Cutting speed vs. emf.

Determining Cutting Tool Temperatures

By Y. C. Lee
CHIEF TOOL ENGINEER
THIRD AIRCRAFT FACTORY TAICHUNG, TAIWAN

AN UNDESIRABLE TOOL temperature, from the metallurgical point of view, may affect the surface structure of the work machined as well as its dimensional accuracy. Excessive tool temperature also causes rapid failing of the tool. For the purpose of obtaining a desirable range of tool temperatures which would provide satisfactory structure and tool life, test runs were made in accordance with the conditions outlined below.

1. Material to be cut:

Material	Size	Composition
Cast iron	8½ in. diameter x 2 in. with ½ in. through hole at center	C 2.75 Si 2.25 Mn 0.69

2. Cutters to be used:

Cutter No.	Type	Hardness Rc	Composition
1	Mo-Max HSS	66-67	C. 0.78-0.84, Cr 3.5-4.0, Mo 8.2-9.7, W 1.3-2.0, V 1.0-1.3
2	German file steel	60-61	C 0.57, Si 0.13 Mn 0.55, Cr 0.23

3. Tool shape:

Back rake 8
Side rake 14
End relief 6
Side relief 6
End cutting edge angle 6
Side cutting edge angle 15
Nose radius ..... 1/16 in. radius

4. Potentiometer: Leeds and Northrup, type 8657C
5. Cutmeter
6. Engine lathe: R. P. C., Japanese-made, one hp.
7. Thermometer: 0-600 deg C
8. Stop watch
9. Lead-tin bath: Pb 84%, Sn 16%
10. Leadwires, silver solder, cutter for clean cuts, insulated tool holders, etc.

Tests proceeded with the cast iron disc chucked to the lathe. Each cutter face-cut the disc from the center outward, with the cutter and the cast iron as two elements of the thermocouple. The emf in millivolts thus generated were read directly with the potentiometer at equal time intervals. The arrangement of the tests is shown in Fig. 1.

While the cutter proceeded along the margin of the center hole, the operation was clocked and readings from the potentiometer were taken every 30 sec. With a known diameter of the center hole and a pre-determined feed in ipr, the cutting speed at the end of each interval is as follows:

$$D_e\ 2 \times \frac{TNF}{60} + d_e \qquad (1)$$

$$\frac{V_e\ \pi\ D_eN}{12} \qquad (2)$$

Where D_e Corresponding diameter of cutting in inches after a cutting time T in seconds
N rpm
f Feed ipr
d_e Diameter in inches of center hole
V_e Cutting speed in fpm at time T

Table I—Cutting speeds and emf generated by two different cutters.

Material Cut: C.I.
f 0.00237 ipr
d Depth of cut 0.032 in.
N 260
d_e: ½ in.
Cutters: Mo-Max HSS
German
Shape: 8,14,6,6,6,15, 1/16 in.

T sec.	D_e in.	V_e fpm	Emf mv		
			Cutter No. 1 HSS	Cutter No. 2	Differential
0	0.50	....	....	....	....
30	1.12	76.0	2.59	1.82	0.77
60	1.73	118.0	3.24	2.19	1.05
90	2.35	160.0	3.90	2.51	1.39
120	2.96	202.0	4.25	2.72	1.53
150	3.58	243.0	4.62	2.96	1.66
180	4.19	285.0	4.90	3.13	1.77
210	4.81	327.0	5.18	3.32	1.86
240	5.42	368.0	5.39	3.50	1.89
270	6.03	410.0	5.75	3.85*	....
300	6.65	452.0	6.05		
330	7.27	494.0	6.34		
360	7.89	536.0	6.54		
390	8.50	578.0	6.90		

*Tool failed

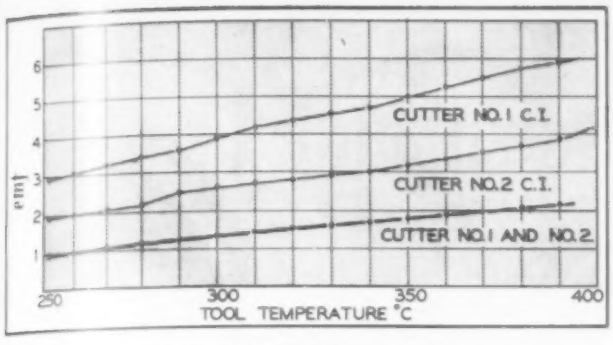


Fig. 3. Tool temperature vs. emf.

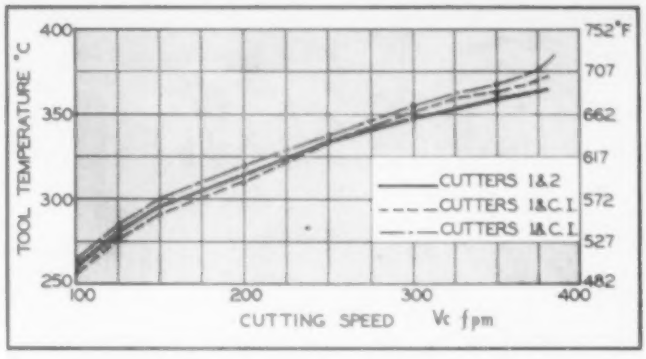


Fig. 4. Cutting speed vs. tool temperature.

A clean cut over the disc surface is necessary before each test cut.

The emf generated by cutter No. 1 and the material cut differed from that generated by cutter No. 2 and the corresponding material. The differential of these two emf readings could be plotted against V_c. Temperature calibration had been worked out, using a lead-tin bath as the heating medium first with the two cutters as a thermocouple, then with cutter No. 1 and the material cut as a thermocouple, lastly with cutter No. 2 and material cut as the thermocouple.

Test Results

1. Cutting speed vs emf (see Table I).

In Table I, values of emf generated by both cutters were obtained at the end of each time interval. Corresponding diameters D_c and corresponding cutting speeds V_c in fpm can be calculated respectively from equations (1) and (2) above. Cutting speeds and emf, thus obtained, were plotted as shown in Fig. 2.

2. Temperature calibration: The heating source used in this test was a lead-tin bath of 16 percent tin and 84 percent lead, which gave a melting point of about 297 deg C. As the test proceeded, the lower range of temperatures needed in the test was as low as 260 deg C. Readings at the vicinity of the melting point were not, it is suspected, as consistent as those from the higher temperature range.

In order to prove that the differential emf indicates truly the tool temperature, a thermocouple with elements of both cutters has been calibrated and two other combinations of cutter No. 1 with the material cut followed. Result of temperature vs emf are tabulated in Table II, and plotted in Fig. 3.

3. Tool temperature vs cutting speed: Fig. 3 shows the relation between emf and tool temperature. It enables us to establish the relation between cutting speed and tool temperature simply by transferring several points from these two figures, as shown in Table III. From this table a chart showing cutting speed vs tool temperature is obtained as shown in Fig. 4.

Table II—Temperature calibration of 3 combinations of thermocouples.

Bath temp. °C	Corresponding Emf mv		
	Both cutters	Cutter No. 1 & C.I.	Cutter No. 2 & C.I.
430	.....	6.58	.....
420	.....	6.43	.....
410	.....	6.28	.....
400	.....	6.09	4.17
390	2.10	5.88	3.85
380	2.05	5.72	3.67
370	1.98	5.49	3.48
360	1.92	5.23	3.31
350	1.82	5.01	3.15
340	1.73	4.74	2.99
330	1.64	4.54	2.88
320	1.55	4.35	2.75
310	1.47	4.21	2.63
300	1.38	3.96	2.50
290	1.24	3.65	2.25
280	1.18	3.45	2.15
270	1.12	3.25	2.06
260	1.00	3.06	1.97

Investigation of Test Results

The temperature difference (Fig. 4) between the temperatures obtained from the two cutters and those obtained from either cutter and the material cut was between 5 deg C. It was felt, therefore, that the results obtained from using the two cutters only as thermocouples is satisfactory. In addition, the author tested some time ago two carbide cutters (Carboloy 833 and 78) in which the differential emf obtained indicated the same category as that from the two cutters described above. Data for these tests are given in Table IV. Thus any two different cutting materials could be used in the test to readily obtain differential emf.

Summary

The test procedure can be summarized as follows:

1. The differential emf (mv) can be obtained by two facing cuts to provide the results as given in Table I and Fig. 2.

2. Calibrate and plot the tool temperature against emf with two cutters as thermocouples to get the results shown in first two columns of Table II and as the bottom curve in Fig. 3.

3. Transfer data thus obtained to provide results shown in first three columns in Table III and the heavy curve in Fig. 4.

Table III—Transferring table.

Cutting speed fpm	Cutter No. 1 & cutter No. 2		Cutter No. 1 & C.I.		Cutter No. 2 & C.I.	
	Emf mv	Tool Temp. °C	Emf mv	Tool Temp. °C	Emf mv	Tool Temp. °C
100	0.95	260	2.94	258	2.00	264
150	1.30	295	3.70	291	2.42	298
200	1.53	317	4.25	314	2.75	320
250	1.70	336	4.66	336	2.98	339
300	1.80	348	4.97	349	3.20	353
350	1.89	360	5.30	364	3.40	365
400	1.98	372	5.60	375	3.75	385

Table IV—EMF vs cutting speed for carbide cutters.

Material cut: C.I.
f 9.9945 ipr
d 0.035 in.
N 432

Initial Dia. d_c: 1.250
Cutters: Carbide 833
Carbide 78
Shape: 0,0,6,6,6,15 .010 in. x 45°

T sec.	D_c in.	V_c fpm	Emf mv			Tool Temp. of
			For 833	For 78	Differential	
0	1.25	141	—	—	—	—
30	3.19	361	9.45	8.20	1.25	750
60	5.13	580	12.83	10.85	1.98	960
90	7.07	800	14.50	12.00	2.50	1100
120	9.01	1020	16.80	12.90	3.90	1500
150	10.95	1240	18.30	13.50	4.80	—

Milling Fixture Design and Use

By Mario Martellotti

DEVELOPMENT ENGINEER, THE CINCINNATI MILLING MACHINE CO.

MILLING FIXTURES, like many standard milling machine attachments, are removable supplementary devices which increase the usefulness and productivity of a milling machine. Fixtures are primarily intended for quantity production, although there are cases in which a fixture may be required to insure the machining of few or even one part of a rather expensive construction to within close limits of accuracy.

The design of a fixture is influenced by the type of operation, the method of milling selected, and the machine in which it will be used.

Since a fixture is a special piece of equipment, its design, maintenance, storage and handling cost should be carefully considered to avoid an investment of capital which may actually not be repaid out of savings effected through the use of the fixture. This is particularly true when a limited number of parts are to be machined in a given production run. Then it is a question of selecting the design which will give the highest production without regard to unit cost, or that design which will give the highest production at a minimum unit cost.

In a production run where large quantities of parts are processed, it becomes less essential to consider the design of the fixture in the light of its initial cost. It is then more important to design the fixture so that the parts are produced a a high rate of production and at a minimum unit cost. It is, however, necessary to remember that simplicity of design is very important from the standpoint of use, as well as of the cost of the workholding fixture. For example, the production rate of the milling equipment is affected by the ease, and, particularly, the time with which a fixture can be loaded, unloaded, and clamped; the number of fixtures used on a machine; and also by the down-time of fixtures for repairs. In many cases, the disposal of chips and the cleaning of the fixture after each machine cycle is a problem which, if not taken care of, will seriously slow down production.

To obtain the degree of accuracy required, it is necessary to consider not only the means of locating the workpiece, but also the method of supporting and clamping it so that the workpiece will be properly set and be rigidly clamped but not sprung during the operation. Three points of support are necessary and should be fixed. If other supporting points are needed, they should be made adjustable and set after the workpiece is clamped against the fixed supports.

A typical hand-clamped fixture is shown in Fig. 1. Here are indicated the essential elements, such as clamps, locating points, supporting surfaces, and setting gage properly arranged in the fixture body to insure satisfactory service.

Other desirable features of a fixture are described in the following:

Rapidity of Clamping

Clamps should always be placed immediately above the fixed points supporting the workpiece. To insure rapidity of clamping, as well as easy removal from and location in the fixture of the workpiece, plain clamps should be provided with a slot so that they can easily be slid back and forth. Furthermore, they should be supported by a spring to keep the clamp in a lifted position. This prevents the clamp from falling down and the resulting loss of time when placing or removing the workpiece from the fixture. The clamps should also be guided in the in and out movement to avoid delay in their use (Fig. 1) by means of a slot engaging the clamp rest at the heel of the clamp.

Plain clamps with a center hole for inserting in the clamping screw should be avoided because they require too much handling time, and, consequently, a loss in production results. These clamps may be satisfactory when it is possible to swing them out of position to clear the workpiece. The angle of swivel of the clamp should, however, be limited by a pin to the amount required to clear the work. The pin can be located in the base of the fixture, or it can be set in the clamping screw by engaging a relieved cylindrical segment

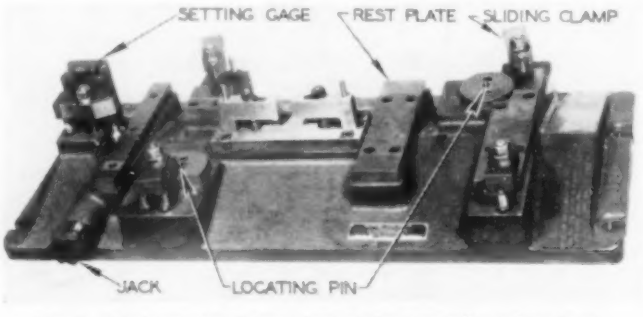


Fig. 1. Hand-operated fixture showing the supporting points, locating points, rest plates, setting gage, adjustable locating point, and spring supported sliding type clamps.

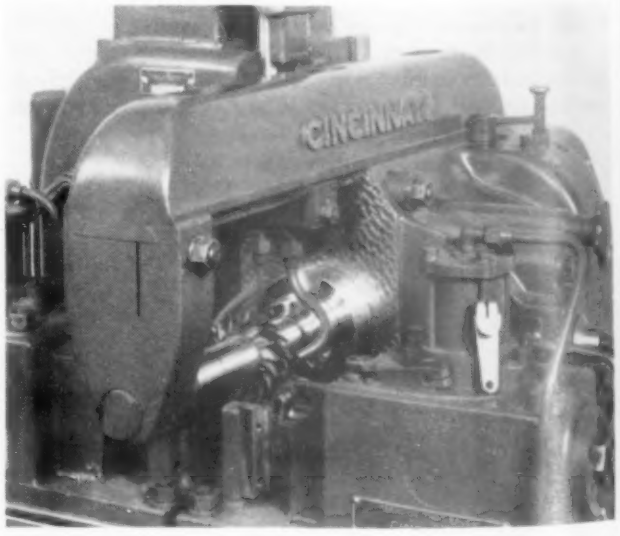


Fig. 2. Compressed air clamping duplex fixture on a rise and fall milling machine.

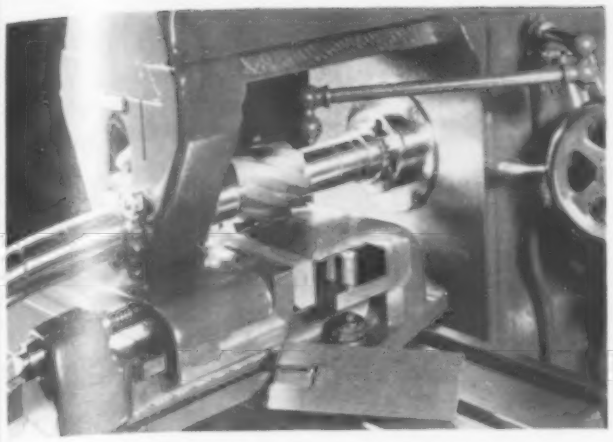


Fig. 3. Simple fixture made up from a standard milling machine vise for slab-milling a plate.

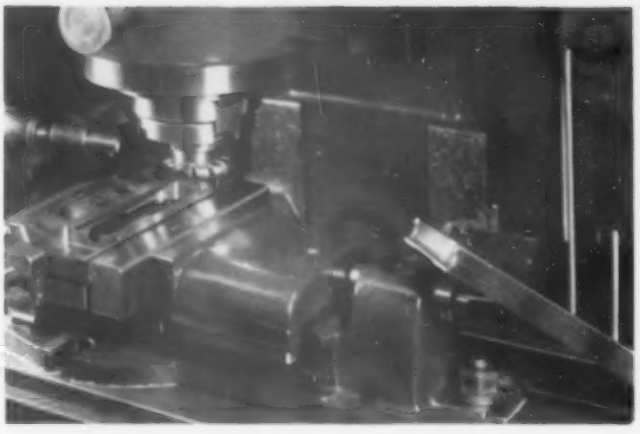


Fig. 4. Standard milling machine vise with special jaws and adjustable stop to form mill the open end of a plate.

machined around the hole of the clamp and extending circularly the amount required for the desired angle of swivel of the clamp. This method produces a more expensive clamp than the simple device of locating a clamp stop on the fixture body.

When it is necessary to reduce the time of clamping and unclamping a part and when the quantity of the part to be milled justifies the added expense, the clamping screws are usually replaced by cams, which can be designed to give an almost instantaneous clamping action and release in conjunction with a very strong gripping effect.

When operating several clamping points simultaneously, compressed air or hydraulic cylinders may be used to simultaneously operate the clamps from a sigle control point. This system has the merit not only of rapid clamping, but also that of providing equal application of clamping pressure at each clamping point. It can also provide a certain regulation of the operating pressure so that this can be set to the intensity just sufficient to hold the workpiece in position.

Pneumatic clamping of an accelerator shaft lever is used in the duplex type fixture shown in Fig. 2 to mill a slot and both sides of the boss in an automatic rise and fall milling machine. This combination resulted in a production rate of 350 pieces milled per hour. The large majority of fixtures, however, are of the hand-clamping type. Rates of production are affected by the time to clamp and unclamp a part and loading and unloading in the fixture. However, most gain in production is secured by the selection of the milling machine and the method of setting up and arranging the cycle of operation so that loading and unloading a fixture takes place while the part or parts in the other fixture is being milled as in the example shown in Fig. 2.

Accessibility for Inserting and Removing the Workpiece

This is a point that must be watched carefully in design of all fixtures. Rapidity of clamping may be nullified by the time spent in placing the workpiece in position in the fixture.

This is a particularly important factor in the use of a fixture, because difficulties arising in either placing or removing the workpiece from the fixture will cause delay in the working cycle of the machine and a loss in the rate of production. This is the reason that makes it necessary to have quickly retractable and positioned clamps (Fig. 1).

Provision for Chip Removal

Easy escape of chips from the fixture by providing sloping surfaces and properly located chip disposal channels (Fig. 1) reduces the time required to clean the fixture after the workpiece has been removed. This is translated into a saving in the idle machine time and a gain in production. An easily cleaned fixture eliminates the danger of chips remaining in the locating surfaces and causing the workpiece to be improperly set in position. This would result in inaccuracy in the milling operation, which may be of such a magnitude as to ruin the workpiece.

Design for Safe Use and Operation of a Fixture

Safety of the operator is an important factor to be considered when designing a fixture. It should also be safe for the cutter by insuring that hardened parts of the fixture are not in the path of the cutter, since accidental contact would dull or break the cutter teeth. To insure safe operation, adjustable supports and clamps should be so arranged that

Fig. 5. Two vises used in reciprocating progressive milling two slots in copper electrode at the rate of 190 pieces per hour.

Fig. 6. Rotary type fixture made up of a standard circular milling attachment and a simple hand fixture for milling a circular slot in a cast iron part.

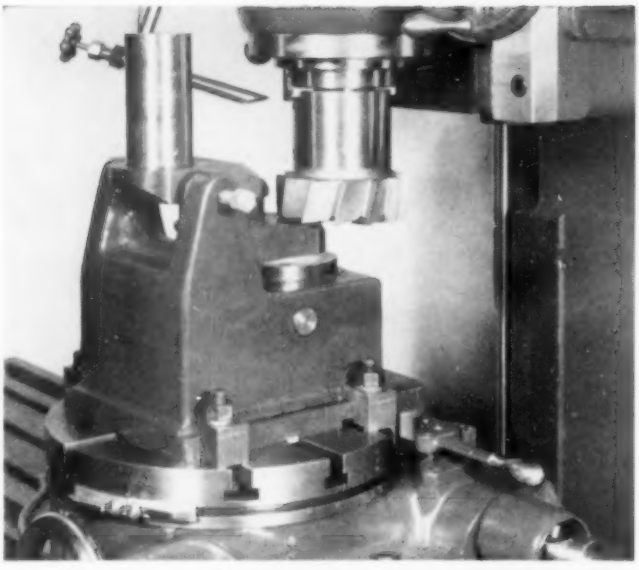


Fig. 7. Circular milling attachment and a simple fixture combined for milling the radius on the cheeks of a single throw crankshaft.

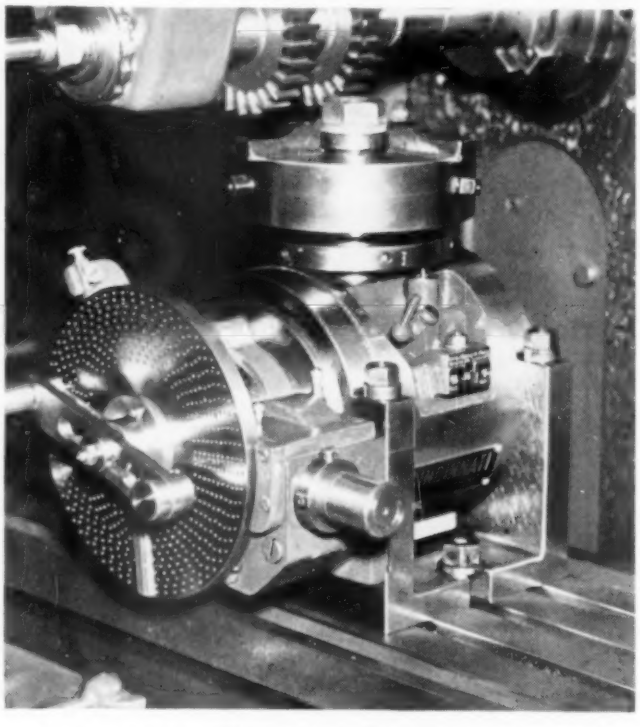


Fig. 8. Universal milling machine dividing head with a chuck mounted on the spindle for milling the sides of a large hexagon nut.

Fig. 9. Two-station index base and simple hand clamping fixture to straddle mill connecting rods.

they can be operated at a safe distance from the path of the cutter; preferably, they should be operated at the front of the fixture. When a number of parts are placed in line in a fixture as in string milling, sufficient space should be allowed between the first and the second piece so that clamping of the second piece can be accomplished without endangering the safety of the operator.

It should also provide properly located hook points for safe handling of the fixture when setting it up on the machine table or when removing it at the completion of the job.

Locating Points

Locating points in the fixture correspond to the locating points in the workpiece. These should be selected so that they can be used as reference throughout the machining operations to be performed on the workpiece and should not be destroyed in subsequent operations. This would require the use of a new set of locating points, and the shift may be a source of inaccuracies in subsequent machining operations.

Locating points in the workpiece may be drilled holes or machined surfaces. Three locating points are required when the workpiece is located from external surfaces, but only two locating points are needed when the workpiece is located from drilled holes (Fig. 1). These may be in line or set diagonally; the latter method is the preferred arrangement. One of the two locating pins is made of a diamond shape, while the other is round. The diamond shaped pin permits locating the workpiece within the allowable variation in the center distance of the two holes, and, in addition, it facilitates insertion in the corresponding hole. For the same purpose, one of the pins is made slightly higher than the other. The head of the pins is provided with a 45 deg chamfer and a lead diameter somewhat smaller than the diameter of the rest of the pin body which corresponds to the diameter of the hole in the workpiece.

Adequate Provision for End Thrust

Adequate provision should be made for taking up end thrust caused by the cutting load. Positive stops should be employed instead of relying entirely on the frictional force at the clamping points. At no time should locating pins be used as stops.

Setting Gages:

To permit proper alignment of the workpiece with the milling cutter, a fixture should be provided with setting gages or blocks (Fig. 1). The setting gage is accurately set with respect to the locating points. If permanently attached to the fixture, the setting gage should be so placed that it is clear of the path of the cutter.

In some cases, the setting gage is made so that it can be removed after completing the alignment of cutter and workpiece.

The design of setting gages varies in accordance with the nature of the part and the operation, and each case should be considered carefully, in order to arrive at a satisfactory selection of gage design and location.

Types of Fixtures

Many milling jobs can be done economically, in either small or large lots, by the use of fixtures which are made up of standard milling attachments. Standard milling machine vises, for example, with relatively easy and inexpensive modified jaws, are often used in production runs of small parts. Vises can be used singly or in pairs on the milling machine table. They can be mounted laterally or swiveled, flat or on angle blocks.

Special vise jaws vary from near standard to complex. incorporated in them for locating and positioning may be studs, pins, end stops, rest plates, angle blocks, V-blocks

Fig. 10. Duplex fixtures rotated by built in hydraulic motor to complete a vee-notch operation. Operation of motor is controlled by automatic machine cycle.

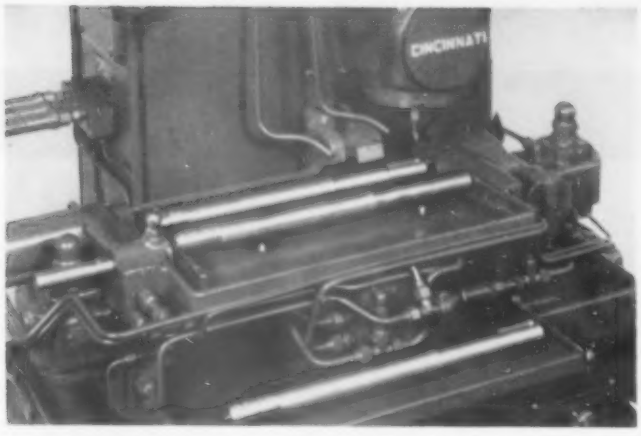


Fig. 11. Fixture for automatically locating, clamping and ejecting the workpiece controlled by the machine cycle.

variable stops and auxiliary clamps. Sets of vise jaws, each pair holding the same part in a new position in the same vise, can be used for progressive manufacture of small lots, where a single machine for each part is not warranted. Fig. 3 illustrates the application of a standard vise, with three studs located between the standard jaws and an end stop, for locating a plate for slab-milling $\frac{3}{32}$ in. from one face at the rate of eleven pieces per hour.

The use of an adjustable stop bolted to one jaw with the jaws made special and extra long to provide clamping the workpiece along its full length is shown in Fig. 4. The production rate in this job is 29 pieces per hour.

Reciprocating progressive milling operation at a high rate of production is obtained in milling slots in a pure copper electrode by employing two vises mounted on the opposite end of a milling machine table (Fig. 5). One of the vises is mounted on an angle block. A slot 0.090 in. wide is milled in the piece at the left-hand fixture; then a deeper slot 0.067 in. wide is milled through the bottom and at an angle to the first slot. The pieces are moved from the fixture at the left to the fixture at the right. The production rate is 190 pieces per hour. This application clearly illustrates the point that it is not necessary to use complicated and expensive equipment to secure high rates of production.

A standard circular milling attachment and a simple hand operated fixture are combined for milling a circular slot in a cast iron part, as shown in the setup in Fig. 6. The rotation of the table of the attachment can be obtained by power or by hand; thus utilizing a standard piece of equipment, which can be used also in other jobs, it is possible to make up a rotary type fixture with a great saving in time and money.

Another example of the efficient combination of a circular milling attachment and a simple hand fixture is shown in Fig. 7 for milling the radius on the cheeks of a single throw crankshaft. The table of the circular milling attachment is operated by power, and the angular displacement is controlled by preset trip dogs which automatically disengage the table rotation upon completion of the milling operation.

The universal dividing head is another standard milling machine attachment which can be used in indexing operations, and, in many cases, without additional equipment. In the example shown in Fig. 8, the faces of a large hexagon nut are straddle milled, while the nut is held in a chuck mounted on the spindle nose of the dividing head.

Another standard piece of equipment is a two-station index base, which permits transferring a workholding fixture through an angle of 180 deg from loading to working position. This base is frequently used for mounting two simple hand clamping fixtures to achieve high production rate by the simple device of permitting the operator to load and unload the fixture at the right (Fig. 9), while milling proceeds on the parts located in the fixture at the left. In the operation shown in Fig. 9, connecting rods are mounted two abreast in each fixture. The production rate is 28 pieces per hour. With this combination, two pieces are milled in the time required to mill one piece.

The complexity of a milling operation sometimes necessitates the design of a fixture which supplements the operation of the machine by providing, in addition to the function of holding the workpiece, that of imparting to it a definite motion, such as is the case illustrated in Fig. 10. In this instance, a circumferential vee-shaped groove is to be milled in saw shanks. The shanks are mounted in the fixture two abreast, and, as the machine table, which holds two fixtures, is moved to place in position one fixture, it slows down to the feeding rate to the correct depth of cut, and it remains stationary while the fixture is rotated by an hydraulic motor built in the fixture and controlled by the machine cycle at slow rate to complete the cut. Production rate in this case is 200 pieces per hour.

To achieve automatic operation of a fixture, to locate, clamp and then eject the workpiece at the completion of the cycle, as in the example shown in Fig. 11 for milling a keyway in armature shafts, the design of the fixture is of necessity complicated, and its cost must be balanced against the gain in production and the resulting unit cost.

This fixture is designed to permit pre-positioning one shaft while the first shaft in the fixture is being milled. The second shaft is placed on an inclined table and comes to rest against two stop pins, which are just visible in Fig. 12. When the milling operation is completed, the spindle carrier rises, clamps are released, and the finished shaft is ejected and it rolls out under the fixture. Simultaneously, the stops are withdrawn, permitting the pre-positioned shaft to roll into position in the fixture. It is then automatically clamped, and the spindle carrier is lowered for the cut. The entire cycle of operation is automatic.

Careful study should always be made of the best method employed in carrying out a milling operation and of the type of fixture to be used for this purpose.

One of the main points to be considered before reaching a conclusion is the quantity of parts to be processed per year, as well as the scheduled number of parts in a lot. If a piece is to be made in such a quantity that one operation keeps a machine constantly employed for months at a time, the fixture designed to save time in the operation by reducing handling time through automatic operation by the machine cycle is more advantageous than a hand operated fixture which will require continuous attention by the operator. But if the pieces come through in relatively small lots, requiring, say, a day to mill, then a simple hand fixture would be selected to reduce the cost of the fixture and to gain in the reduction in setup time which must be charged to this one lot.

General Engineerin

Classified Accordi

STRUCTURAL GRADES—CARBON STEELS								
Tensile Strength, psi	60,000	65,000	70,000	80,000	85,000	100,000	70,000	80,000
Indicated Application	Low electric resistivity Desirable magnetic properties carburizing and case hardening grades weldability	Excellent Weldability Medium strength with good machinability and high ductility		High strength carbon steels with good machinability, toughness and excellent fatigue resistance		Wear resistance hardness	Excellent Weldability Medium strength with toughness and good machinability	
Current Specifications	ASTM: A27-46T U60 — 30 60 — 30 ASTM: A216-44T WCA AAR: M201-46 Grade AU Grade AA Federal: QQ-S-681b Class 1 Navy: 49S1 Class B & D A.B.S. Class 1	ASTM: A27-46T 65 — 30 65 — 35 SAE: Auto. 0030 Federal: QQ-S-681b Class 2 ABS Class 2 Lloyds Class A	ASTM: A27-46T 70 — 36 ASTM: A95-44 70 — 36 ASTM: A216-44T WCB AAR: M201-46 Grade B AREA	SAE: Automotive 080 Federal: QQ-S-681b Class 3 Navy: 49S1 Class A	SAE: Automotive 0050	SAE: Automotive 0050	ASTM: A157-44 C 1 ASTM: A217-46T WC 1 WC 2 WC 3 Navy: 46S33 (Int) A	ASTM: A
A Typical Specification for the Tensile Grade with Requirements listed below	ASTM A27-46T Class 60 - 30	ASTM A27-46T Class 65 - 35	AAR M201-46 Grade B	Federal QQ-S-681b Class 3	SAE: Automotive Class 0050	SAE: Automotive Class 0050	ASTM A157-44 Class C1	ASTM
All values listed below are specification minimum values.								
Tensile Strength, psi	60,000	65,000	70,000	80,000	85,000	100,000	70,000	80,000
Yield Point, psi	30,000	35,000	38,000	40,000	45,000	70,000	45,000	50,000
Elongation in 2", %	24	24	24	17	16	10	22	22
Reduction of Area, %	35	35	36	25	24	15	35	35
Brinell Hardness No.	—	—	—	—	170	207	—	—

Values listed directly below are those normally expected in the production of St
The values listed below are only for general information a

Tensile Strength, psi	60,000	65,000	70,000	80,000	85,000	100,000	70,000	80,000
Yield Point, psi	30,000	35,000	38,000	45,000	50,000	70,000	42,000	50,000
Elongation in 2", %	30	30	28	26	24	20	28	27
Reduction of Area, %	50	53	50	43	40	43	55	50
Brinell Hardness No.	120	130	140	160	175	215	140	160
Charpy Impact** at 70° F ft. lbs.	35	35	30	35	30	25	35	30
Charpy Impact** at —50° F ft. lbs.	8	12	10	12	12	15	15	15
Endurance Limit psi	25,000	28,000	31,000	35,000	38,000	47,000	33,000	38,000
Modulus of Elasticity	30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	30 million
Machinability Rating†	55	60	65	70	70	65	65	70
Type of Heat Tr.	Annealed	Normalized	Normalized	Normalized and Tempered	Normalized and Tempered	Quenched and Tempered	Normalized and Tempered	Normal and Tem

* Below 8 percent total alloy content.
** Keyhole Notch.
† Machinability Rating by Research Committee on Cutting Fluids—Metal Progress Oct. 1943, p. 622-624. Cold rolled screw stock equals 1
†† Test values obtained in accordance with ASTM testing procedures.
‡ SAE Hardness requirement.

pes of Steel Castings

Tensile Strengths

ENGINEERING GRADES—LOW ALLOY STEELS*							
90,000	100,000	110,000	120,000	150,000	175,000	200,000	Tensile Strength, psi
Certain steels of these classes have excellent high temp properties and deep hardening properties Toughness		High resistance to impact Excellent low temp properties for certain steels Deep hardening Excellent combination of strength and toughness		Deep hardening High strength Wear resistance Fatigue resistance	High strength Wear resistance High hardness High fatigue resistance		Indicated Application
STM: A148-46T 90 — 60 STM: A157-44 C 3 AE: Automotive 090 Federal: QQ-S-681b 4A2, 481, 482, 4C1 Navy: 4951 (Int) Grade F AAR: M201-46 Grade C	ASTM: A157-44 C 11 Federal: QQ-S-681b 483	ASTM: A148-46T 105 — 85 SAE: Automotive 0105 Federal: QQ-S-681b 4C2	ASTM: A148-46T 120 — 100 SAE: Automotive 0120 Federal: QQ-S-681b 4G3	ASTM: A148-46T 150 — 125 SAE: Automotive 0150 Federal: QQ-S-681b 4C4	ASTM: A148-46T 175 — 145 SAE: Automotive 0175	None specified	Current Specifications
ASTM A148-46T Class 90 - 60	Federal QQ-S-681b Class 483	ASTM A148-46T Class 105 - 85	ASTM A148-46T Class 120 - 100	ASTM A148-46T Class 150 - 125	ASTM A148-46T Class 175 - 145	None specified	A Typical Specification for the Tensile Grade with Requirements listed below
All values listed below are specification minimum values.							
90,000	100,000	105,000	120,000	150,000	175,000	—	Tensile Strength, psi
60,000	65,000	85,000	100,000	125,000	145,000	—	Yield Point, psi
20	17	17	14	9	6	—	Elongation in 2" %
40	30	35	30	22	12	—	Reduction of Area, %
—	—	217†	248†	311†	363†	—	Brinell Hardness No.

stings for the tensile strength values given in the upper portion of the chart.†† e not to be used as design or specification limit values.

90,000	100,000	110,000	120,000	150,000	175,000	200,000	Tensile Strength, psi
60,000	65,000	85,000	97,000	130,000	148,000	175,000	Yield Point, psi
24	21	18	16	12	8	5	Elongation in 2", %
50	46	42	38	25	15	11	Reduction of Area, %
190	215	235	260	325	380	420	Brinell Hardness No.
26	22	28	24	18	10	—	Charpy Impact** at 70° F ft. lbs.
17	15	22	18	15	6	—	Charpy Impact** at —50° F ft. lbs.
41,000	45,000	49,000	55,000	65,000	77,000	85,000	Endurance Limit psi
30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	30 million psi	Modulus of Elasticity
70	65	60	50	30	—	—	Machinability Rating†
Normalized and Tempered	Normalized and Tempered	Quenched and Tempered	Quenched and Tempered	Quenched and Tempered	Quenched and Tempered	Quenched and Tempered	Type of Heat Tr.

—Data Courtesy of Steel Founders' Society of America

By C. F. Brown

Reversible Low Production Tool for Irregular Casting

A LOW PRODUCTION run was an important requirement for a drill jig on the casting shown in Fig. 1. Of irregular shape, the casting was to have two No. 29 (0.136) holes drilled in both sides, and located from two lugs on the casting. The lugs had been milled at an angle of 10 deg from the base; the 7/8 in. dimension locating the holes from the 1/4 in. cast radius was not a critical dimension, but could vary slightly with each casting. Since the milled lug already contained two 1/4 in. -20 tapped holes from a previous drilling operation, it was decided to locate the tool from these holes.

The drill jig developed for the job is shown in Fig. 2. It consists of a piece of flat stock (Part 1), which forms the body of the tool and holds the drill bushings (Part 8). The end of the tool (Part 2) is fastened to the body by means of a socket head screw (Part 6) and two dowel pins (Part 5). The end piece contains a 0.201 in. diameter locating pin (Part 4) protruding from either side of the end piece. This pin locates the tool on the root diameter of the upper 1/4 in. -20 tapped hole in the milled lug. The locating screw (Part 3) serves the purpose of locating in the lower 1/4 in. -20 hole and at the same time draws the tool tightly against the milled face of the lug. A No. 5-40 x 3/8 in. round head machine screw retains the locating screw in the head piece. This small screw nests in the 0.187 in. diameter undercut section of the locating screw.

The tool as shown in Fig. 2 is set up to drill the two No. 29 holes in the right side of the casting (see Fig. 1). All the castings in the lot were drilled on this side first. To drill the left side the castings are reversed; the socket head screw is removed and the end piece is fastened to the opposite end of the body. The locating screw is reversed by removing the round head machine screw, turning the piece around and replacing the retaining screw. The tool is then ready for use.

It may be noted that the cost of layout work alone on these intricately-shaped castings, in locating the holes, would greatly exceed the cost of the drill jig on a relatively low production run.

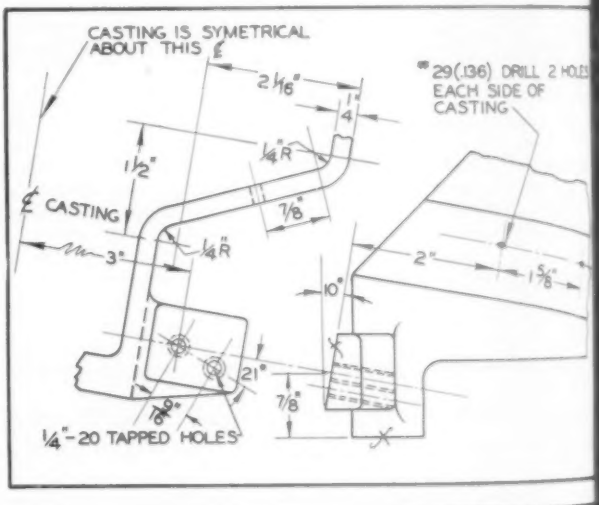
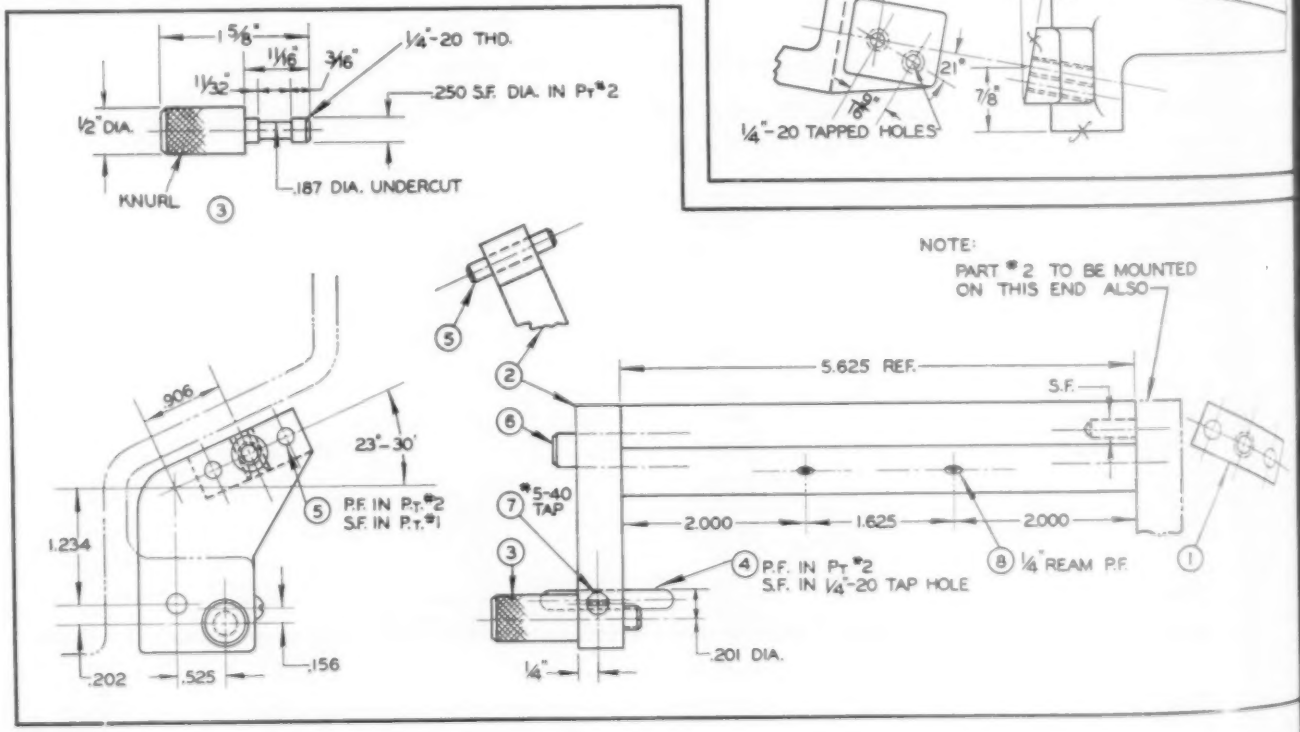


Fig. 1 (Right) illustrates the irregularly-shaped casting which required the drilling operation. Fig 2 (below) shows the drill jig developed for the operation.



GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Safety Curtain for Heat Treating

Heat treating operations which require placing the work in open lead pots or cyanide baths, create a hazard of

Curtain protects worker from flying hot particles.

flying hot particles if the work is not perfectly dry. To prevent injury to the operator, a curtain of fireproof duck material equipped with a window of safety glass, can be used as illustrated.

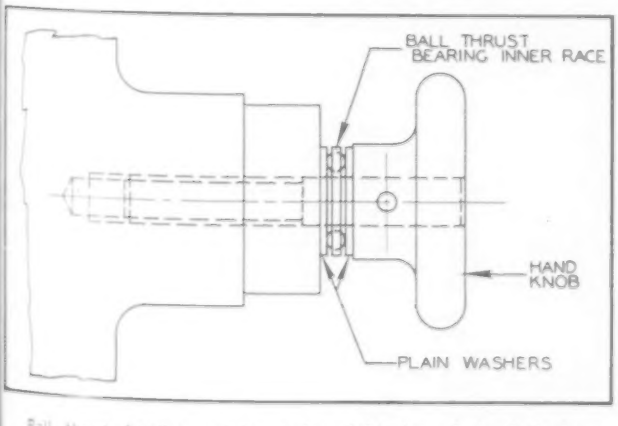
This curtain will provide ample vision with adequate protection for the operator, yet without interfering with his work. Not shown in the photo is a small-diameter rod, which can be added to the bottom of the curtain to prevent it from curling.

E. S. Guilbert, Safety Director,
Republic Drill & Tool Co.,
Chicago, Ill.

Ball Thrust Reduces Clamping Friction

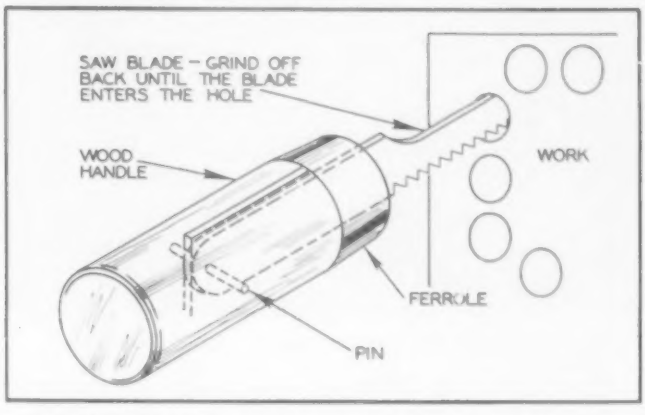
On jigs and fixtures where it is necessary to use a hand knob for clamping purposes, operator fatigue can be greatly reduced by the method illustrated. If a standard ball thrust bearing race is placed between two hardened washers over the knob stud, it will make it infinitely easier to tighten and loosen the handknob. In addition, more positive clamping can be obtained.

Roger Isetts
Racine, Wisconsin



Ball thrust bearing permits easier tightening of hand knobs.

Saw-Blade for Small Holes



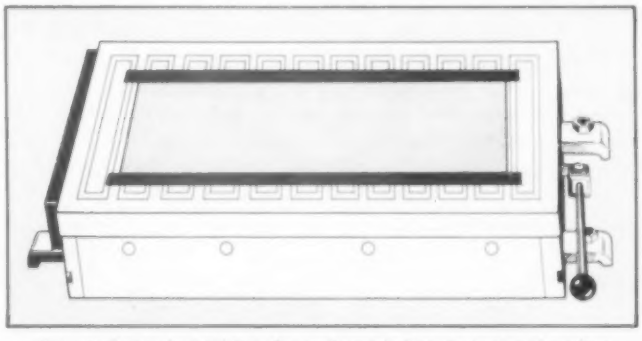
A broken saw blade, inserted in a handle and ground down as shown, serves to cut bridges between small holes.

The bridges between small holes, such as are drilled in dies, may be readily sawed through by means of a broken hacksaw blade held in a wooden handle, as shown. The handle is sawed part way and closed against the blade with a ferrule. A pin through the hole will then hold the blade firmly. The top of the blade is ground off until the width suits the diameters of the holes in the workpiece.

Federico Strasser
Santiago de Chile

To "Chuck" Thin Stock

When it is desired to surface grind non-ferrous sheet stock in small quantities, without making up a special fixture, taping two edges of the material to a chuck or a flat plate with Scotch tape will provide a satisfactory means of holding. The material must be left oversize since the edges covered by the tape (parallel to the travel) will not be ground and must be trimmed off afterwards.



Thin stock may be held flat, for surface grinding, by taping the edges to a magnetic chuck or flat plate with Scotch tape.

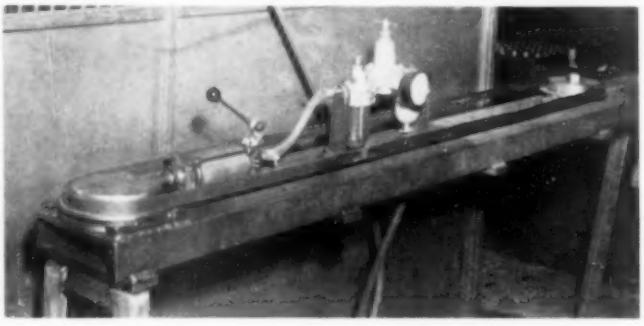
This method can also be used for ferrous sheet stock that is too thin—less than about .012 in.—to be held securely by a magnetic chuck. In both cases very light downfeeds must be used, but on tool room work or small production lots this is more than made up by the saving in set-up time.

P. H. Winter
Syracuse Chapter, ASTE

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

V-Belt Inspection Fixture Matches Belts and Checks Size

Whenever multiple V-belt drives are used, whether it be in your plant or on your own product, it is imperative to match belts accurately in order to increase belt life, reduce whipping and improve the efficiency of the power transmission. Matching can be accurately effected by the fixture shown.



Photograph of the belt inspection fixture as actually made and installed.

Although V-belts may be purchased in matched sets there are various factors, such as atmospheric conditions—especially temeprature and humidity—as well as handling and storage methods that may change the lengths of belts enough to unbalance the matched sets. This fixture is therefore a welcome help to the inspection or assembly department and should be used immediately preceding the installation of belts in the final assembly.

The fixture consists mainly of two rollers of which one is free to rotate while the other is mounted to slide on rails. The rotating roller is removable and can be mounted in one of several positions to allow use of the fixture for various belt lengths. The sliding roller is activated by an air cylinder, with valve, which is connected to the plant air supply through oiler, filter and pressure regulator. This roller is fitted with an indicator hand which slides over a scale mounted on the fixture base. All fixture parts are built on structural channel of such length to accommodate the longest belt.

A stretching force (F) of 165 lbs and a minimum pitch diameter of checking roller (D_p) of 6 in. were suggested by a belt manufacturer for belts up to and including 9/16 in. height (H). Since the relationship of belt pitch diameter and belt inside diameter is usually constant the rollers were made to fit the inside diameter of the belt rather than being machined with V-grooves.

To obtain correct setting of the pressure regulator the desired stretching force (F) must be divided by the area of the air cylinder. If a cylinder of 2½ in. bore is selected and its area equals 4.9 sq. in., then the setting of the pressure regulator should be:

$$P = \frac{F}{\text{area}} \; ; \; P = \frac{165 \text{ (lbs)}}{4.9 \text{ sq. in.}} = 33.7 \text{ lbs/sq. in.}$$

A red pencil mark on the pressure gage dial of the regulator will assure correct adjustment by the operator. The checking operation is fast and simple; the belt is placed on the two rollers, the air cylinder valve is opened and the scale read. For comparative tests, a machinist's scale mounted on the base may be used; for absolute length checks, two scales placed end to end to form a neutral point are preferable.

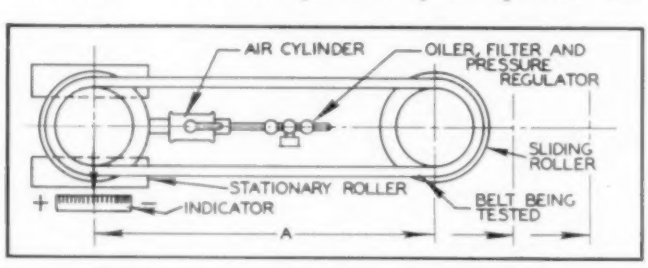
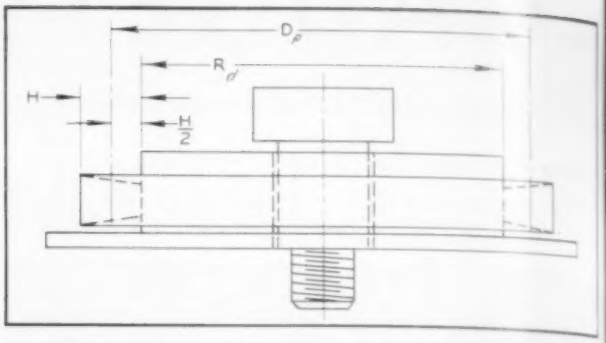


Diagram of the belt inspection fixture. A=Lp—Dp/2, In which L is the pitch length of the belt and is listed in belt manufacturers' catalogs.

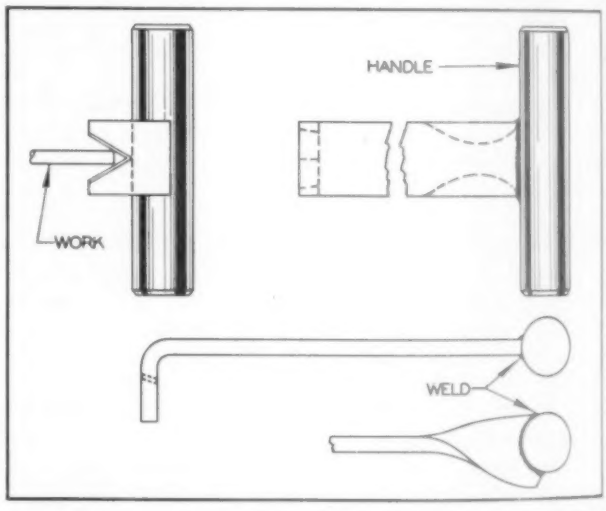


Detail of stationary roller. The actual roller diameter (Rd) as well as the proper spacing (A) for any belt pitch length (Lp) can be calculated as follows: Rd=Dp—H.

H. G. Frommer, ASTE Member
Trackson Co., Milwaukee, Wis.

A Handy Burring Tool

The "Gadget" illustrated is a simple, easy-to-make tool that will quickly remove burrs from large pieces of sheared or sawed sheet stock. It eliminates the tedious grinding or filing that is usually incidental to such deburring operations, and is so constructed that it can be used for either thin or fairly thick stock.



The Veed scraper shown will quickly remove burrs or feather edges from sawed or sheared sheet stock.

A Vee is machined in a length of flat tool steel, as shown, and this end is then bent over at right angles. A section of cold rolled steel, about ⅝ in. diameter x 4 in. long, is welded to the opposite end to serve as a handle. The Vee is then backed off slightly, to provide a sharp cutting edge, and hardened.

The work may then be clamped in a vise or otherwise held, and the tool drawn across the edge with hand pressure just over the bend. For extra hand comfort, the end close to the handle should have the edges rounded off, so as not to chafe the fingers; for that matter, it can be necked or even twisted, as shown at lower right.

Roger Isetta
Kenosha, Wis.

C. H. Smith

E. W. Spitzig

Islyn Thomas

M. C. Overholt

E. P. Blanchard

V. M. Drury

M. G. Baker

C. D. Wright

J. B. Savits

C. P. Farr

A. S. T. E. NEWS
Doris B. Pratt, *Editor*

More Speakers Named on Montreal Program

Society's Fall Convention Promises Wealth of Production and Process Data

SPEAKERS FOR three more technical sessions have been added to the program of the ASTE 17th semi-annual meeting at Montreal, October 27-29, announced in the September *Tool Engineer*.

The head of one of the city's major industries has accepted an invitation to address the opening luncheon and an international food processing concern has offered to escort ASTE ladies through its local plant during the Society's semi-annual convention at the Mount Royal Hotel.

On Thursday afternoon M. C. Overholt, general superintendent of tool production, Peerless Engineering, Ltd., Toronto, will talk on "Mold Die Finishing." His paper will be based on: (1) selection and application of tools for cavity cutting; (2) a better way of machining cavities for easy finishing; (3) proper finishing for a mold cavity; and (4) advantage and application of liquid honing in mold finishing for certain plastics.

Followed by Hobbing Procedure

The accompanying subject, "Mold Die Hobbing," is to be presented by Islyn Thomas, president, Thomas Manufacturing Corp., Newark, N. J., and Edmund W. Spitzig, hobbing supervisor, Newark Die Co., Newark, N. J. They will describe the procedure of sinking a hardened, highly polished steel master die into a piece of soft steel by hydraulic press, to form single or multiple cavity molds for plastics.

The plastics tooling experts will explain the application of hobbing; when machining is preferable; when a combination of the two methods is best. Operation of hydraulic presses, design of hobs, selection of steel for hob and hobbing blanks, use of hobbing rings, and precautions to insure successful hobbing operations also will be included in their lecture.

J. M. Rudel, president, Rudel Machinery Co., Ltd., Montreal, is to conduct this meeting.

Carleton H. Smith, manager, Montreal branch, Canada Metal Co., will deal with "Use of Low Melting Point Alloys for Tool and Die Work" at a Friday morning session. Since joining this firm in 1932 as chemist, Mr. Smith has advanced through various production executive posts. During his service as plant superintendent, he was in charge of the company's Kirksite die division.

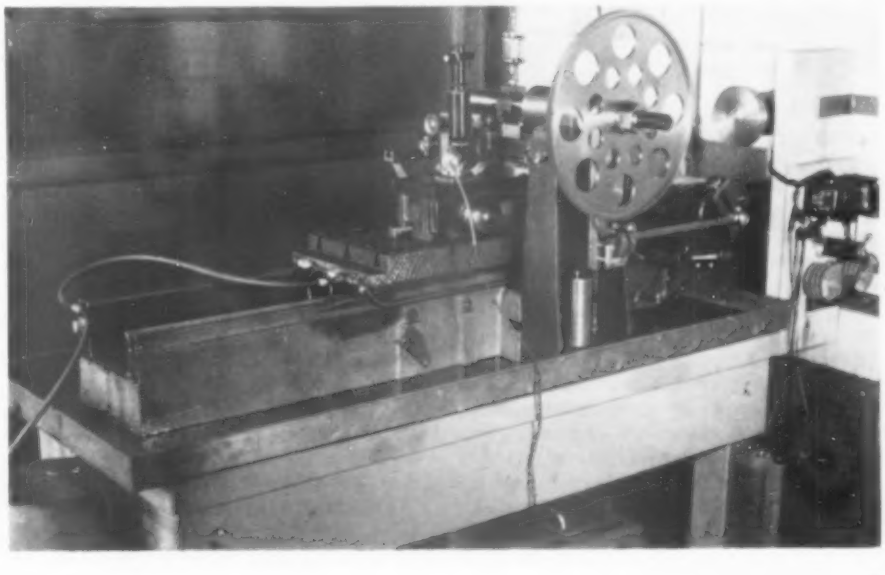
A. B. Chevrier, sales engineer, Upton Bradeen & James, Ltd., Montreal, is presiding chairman.

Blanchard Opens Symposium

A symposium on Friday afternoon will give a comprehensive analysis of the whole problem of limited production. In setting forth the economics, E. P. Blanchard, general sales manager, The Bullard Co., Bridgeport, Conn., will define the term "limited production," evaluate methods, tooling setups and fixtures. Mr. Blanchard will outline economical scheduling of repetitive jobs.

J. B. Savits, methods engineer, Pneumatic Scale Corp., North Quincy, Mass., will appraise tools and materials concerned in this type of manufacture. He

Designed and built by General Motors Research Laboratories to rule as many as 10,000 lines to the inch on geometric surface finish standard specimens, this machine will be described during the surface finish session at the Montreal convention. The program, co-sponsored by Chrysler Corp., will be the first public presentation of the new development.



At the Montreal plant of Standard Brands, the visiting ASTE ladies will watch coffee tasters sampling each batch. The trained tongue and palate of the expert still is the best method to determine excellence of roast and blend.

will also consider methods, how to determine when to buy rather than manufacture, how to fit in short run jobs with regular production work.

The quality control or inspection angle will be handled by C. D. Wright, chief engineer, Reliable Toy Co., Ltd., Toronto. In telling where to emphasize inspection and place responsibility for it, Mr. Wright will indicate how to determine inspection method and guard against carelessness of workers.

M. G. Baker, sales engineer, Canadian General Electric Co., Ltd., Montreal, is scheduled to chairman the panel discussion.

Until recently hospitalization has prevented Sam Tour, chairman of the board, Sam Tour & Co., Inc., New York City, from preparing his lecture, "Hot Spot Machining," for the Friday evening study of "Hot Machining."

After outlining theoretical considerations leading to the introduction of this work in his company, Mr. Tour will weigh relative merits of methods used to heat the workpiece and describe the new tool dynamometer developed for this process. Metallurgical examinations of finished work, he will point out, indicate no change in the material. In conclusion he will summarize advantages of hot spot machining.

Farr to Talk on Special Machines

"Special Purpose Machines from Standard Units," the subject originally assigned to Edgar L. Barker, president, Modern Tool Works, Ltd., Toronto, is to be presented by Clifford P. Farr, chief engineer of the same company, on Friday morning.

One interesting phase of the Thursday evening surface measurement session will feature a description and photographs of the machine developed by General Motors Corp. to rule geometric surface finish standard specimens.

A. F. Underwood and Roy P. Trowbridge of the Research Laboratories Division, will explain the equipment, similar to that used to rule diffraction gratings, designed and constructed by their company. Essentially a small planer, the machine has a diamond tool of known cross section which presses a groove in the surface being ruled without removing any metal. Weight placed on the tool regulates the depth of the marking.

While frequency of rulings in specimens varies from 125 to 5000 per inch, the machine can rule up to 10,000 lines to the inch, employing accurately calibrated lead screws and indexing gear.

The original master surfaces are ruled in pure gold, polished to a fine mirror finish. They are then reproduced by a plating process. Calibration of the surfaces is accomplished by taper sectioning these replicas. This method is said to be accurate within five percent.

To Be Standards for Industry

When the geometric standards are available to industry, they will be to surface finish as Johannson blocks are to gaging, it is predicted.

Preprints of most of the convention technical papers are expected to be available shortly. They may be obtained during and after the convention.

* * *

When the convention opens Thursday noon, Victor M. Drury, president and chairman of the executive committee of Canadian Car & Foundry Co., Ltd., will address a reception luncheon, comparing "Operating Tools as Used in the United States and Canada."

Mr. Drury's broad business background embraces the presidency of transit, power and holding companies and service on boards of paint and match companies, power, insurance, banking and transportation firms, and civic organizations.

That afternoon the ASTE ladies will learn how some of their favorite brands of nationally advertised food products reach the grocer's shelf in prime condition and attractive packages.

In the Montreal Standard Brands plant, coffee experts continually sample blends, and giant mechanical roasters dry green coffee beans to the exact color set as a standard of excellence. The women visitors will also see growing yeast bubbling in immense vats and marvel at precisionally synchronized tea ball machines.

They'll follow packaging lines speeding powdered pudding and gelatine dessert preparations, quality control processed to meet the housewife's demands for low price and high quality.

From industrial centers throughout the United States, Ontario, Quebec and elsewhere, reservations are piling up for the three days of technical, business and social activities.

The timely technical topics, concentration of heavy industry, historical charm, foreign atmosphere and shopping attractions make Montreal one of the most appealing convention locations ever chosen by ASTE.

If you missed the reservation card insert in the September issue, hunt it up or write to the National Program Committee, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich. They'll reserve your hotel accommodations for the period you indicate.

Tool Engineer Admitted To ABC Membership

Detroit, Mich.—*The Tool Engineer* has been accepted as a member of the Audit Bureau of Circulations, Chicago, Ill.

Among publications in the metalworking field that the Society's magazine has joined in its ABC affiliation are: *Iron Age*, *American Machinist*, *Metal Progress*, *Machinery*, and *Steel*.

Membership in the ABC assures a certified audit of paid circulation. The geographical and vocational analysis of subscribers is valued by advertising agencies in studying markets for their clients' products and in arranging advertising schedules.

The Tool Engineer total paid circulation consists of: corporate officials and general managers, 19.61 percent; plant and production department managers and superintendents, 9.49, supervisors, foremen and other personnel, 11.91; engineering and design department heads, engineers and others, 40.30; metallurgical and chemical department heads and engineers, 0.24, metallurgists and others, 0.55; purchasing, 0.33; sales, 9.24; all other employees, 1.52, and unclassified by occupation, 6.81 percent.

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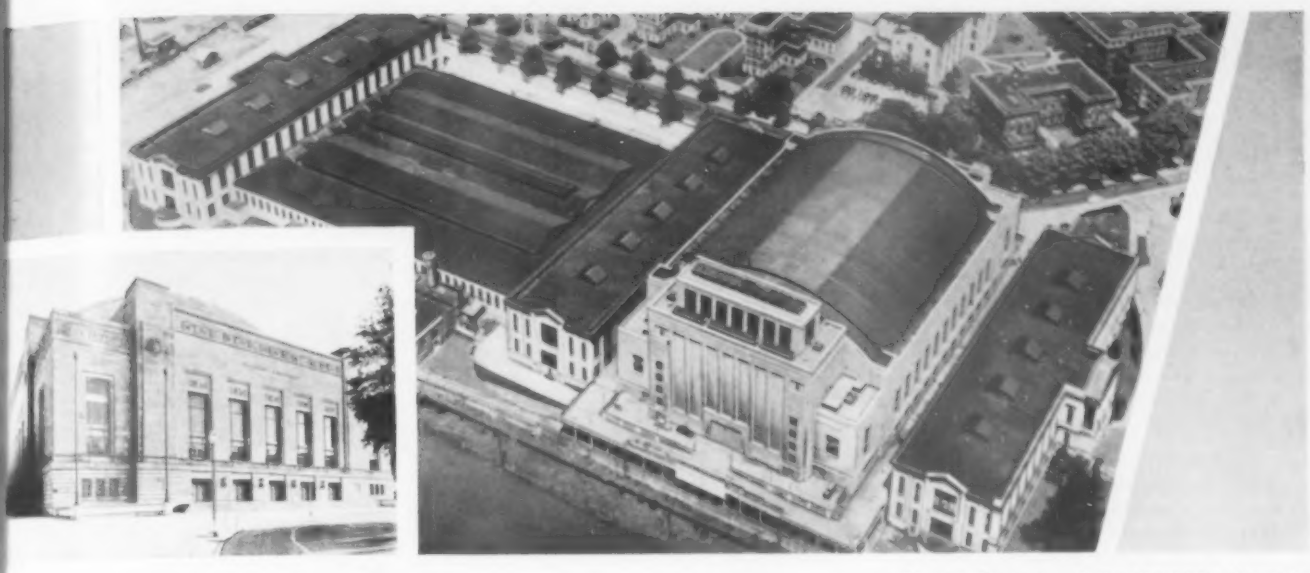
Chapter listings include member as well as meeting news.



This vast floor space of the Philadelphia Convention Hall and Commercial Museum will be required for the array of cost cutting manufacturing equipment which American industry will present at The Tool Engineer's Industrial Exposition, April 10-14.

'Cost Cutting' to Be 1950 ASTE Exposition Theme

AMERICAN INDUSTRY is preparing a counteroffensive in the battle of mounting labor and material costs. It will concentrate its cost cutting equipment, for the benefit of all manufacturers, at the Tool Engineer's Exposition in Philadelphia's Convention Hall and Commercial Museum, April 10 through 14.

Sponsored by the American Society of Tool Engineers, the 1950 show will run concurrently with the Society's 18th annual meeting. Acres of machines, machine tools, small tools, accessories, processes, services and other aids to more, better and lower priced production are expected to fill the entire ground floor of the two connecting buildings. Plans for the big show also include assistance in rehabilitating foreign industries.

R. B. Douglas, ASTE president and spokesman for the Exposition Advisory Committee, anticipates that this seventh exposition will be the most important one ever presented by the Society. Serving on the committee with Mr. Douglas are H. L. Tigges, first vice-president, of Toledo, and G. A. Goodwin, national treasurer, of Dayton.

H. E. Conrad, executive secretary, is manager, and J. V. Friel of Reber-Friel Co. is operating show manager.

Location Is Advantageous

The Eastern Pennsylvania city was chosen for its geographical and physical advantages. Home town of the third largest chapter in the Society and overnight from a majority of other chapters, it is readily accessible by highway, rail, water and air to nearly every type of industry in the United States.

Hotel accommodations to house visitors and exhibitors' staffs are greater than those available at other adequate sites. The exposition buildings are within nine minutes of most downtown hotels. They provide facilities for holding the convention technical sessions and for showing exhibitors' motion pictures.

Services include excellent restaurants, convenient lounges, complete telephone equipment, and stenographic help. Reasonable labor rates for exhibitors are guaranteed.

Floor plans and exhibit data have been distributed to former and prospective exhibitors. Display areas are being reserved in accordance with exhibitors' preferences. Actual space assignments will be made on a basis of exhibitor seniority, physical requirements of displays, classification of exhibits and relation to competitive exhibits. Space units ranging from 10 x 10 feet are available at $3 per square foot.

Both members and nonmembers may visit the exposition throughout the week for a registration fee of $1. This includes admission to technical sessions and plant tours on the convention program. Attendance will be strictly invitational, made up from guest lists of the Society and its exhibitors.

Descriptive literature, floor plans and space application forms may be obtained on request from the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Opens Consulting Office

Syracuse, N. Y.—Victor E. Hall of Syracuse chapter, ASTE, has entered private practice as a consulting engineer with offices at 1534 Glenwood Avenue, according to a recent announcement.

For the past nine years he has served as manager of the Engineering and Materials Handling Division of Syracuse Supply Co. Earlier he operated Hall Engineering Co., at Binghamton.

A licensed Professional Engineer, Mr. Hall is also secretary of Syracuse chapter, American Material Handling Society and a member of the National Society of Professional Engineers, American Society of Mechanical Engineers and the Society for Experimental Stress Analysis.

Kahn Retires from Trico

Buffalo, N. Y.—After 25 years with Trico Products Corp., Jesse O. Kahn retired September 1 from the superintendency of the Screw Machine Division. Mr. Kahn is a member of Buffalo-Niagara Frontier chapter, ASTE.

Coming Meetings

CHICAGO—November 18, Western Society of Engineers, 84 E. Randolph. Speaker: L. B. Bellamy, ASTE member of Standards Council, American Standards Association, and Adam Gabriel, Sr., ASTE representative on ASA Committee B-46, Classification of Surface Qualities, and Committee B-5, Jig Bushings. Subject: "Standards and the Tool Engineer."

CLEVELAND—October 14. Speaker: W. E. Way, Electrolized Tap Corp. of Ohio. Subject: "Electrolyzing." Coffee speaker: Cook Cleland, Thompson trophy winner. November 11. Speaker: R. R. Rhodehamel, vice-president, National Acme Co. Subject: "Fifty Years of Progress with the Master Tools of Industry." Coffee speaker: A. C. Body, patent counsel.

HARTFORD—November 7. Technical session. November 11. Ladies Night, Avon Country Club.

INDIANAPOLIS—November 3, 7:00 p.m., The Athenaeum. Speaker: J. L. Erickson, president, James L. Erickson Sales, Inc., Dayton, Ohio. Subject: "Modern Die Casting Die Design."

MONTREAL—October 27, 28, 29, Mount Royal Hotel. ASTE 17th Semi-Annual Meeting. October 28, Semi-Annual Meeting, Board of Directors.

TORONTO—November 2. Speaker: A. Gray, Gray Forgings & Stampings Co., Ltd. Subject: "Mechanics' Hand Tools."

WORCESTER—November 8, 3:00 p.m., plant tour, Harrington & Richardson Arms Co., 329 Park Ave.; 6:45 p.m., dinner at Putnam & Thurston's Restaurant; 7:45 p.m., technical session. Speaker: E. B. Rhodes, industrial sales department, Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio. Subject: "Labor-Saving Applications of Air-Operated Holding Devices."

Situations Wanted

DIE CAST AND PLASTIC ENGINEER—11 years' experience in die casting; 13 in plastic and rubber mold design. Has served as chief engineer for tool and die concerns and as sales engineer for product design, dies and secondary tooling. Details available from Box 184.

GRADUATE—With degrees in production engineering, machine designing, die designing and drafting. Has practical experience in tool and die work. Veteran, age 25, ambitious. Please write to Box 182.

MANUFACTURING TOOL ENGINEER—Seeks position with progressive company. Extensive experience in tool design, toolmaking, methods, time study, quality control, standards, drafting, product design and development and cost reduction. Broad administrative background. Graduate electrical engineer. Married. Location unimportant. Box 181.

PROCESS ENGINEER—30 years' experience in automotive and electrical parts manufacturing. Background in writing production reports, supervising tool design, toolmaking, tool follow-up and case studying production setups. Middle West location desirable. Detailed information on request. Box 180.

PRODUCTION MANAGER—36, seeks responsible position. Fifteen years' experience in engineering and management, including five years as chief process engineer. Prepared to install production control system with inventory control. Excellent knowledge of tooling, castings, procurement procedures. Technical school graduate, married, free to travel, willing to locate anywhere. Please address replies to Box 179.

TOOL DESIGNER—Experience in automotive vehicle and accessory field includes product drafting. For further information write Box 183.

TOOL ENGINEERING EXECUTIVE—44, seeks position as tool design, tool room, die shop or press room superintendent. Experience in tool and die production includes cold rolling, pickling, heat treating, application of tool steels, carbides and lubricants. Author of textbook and serial articles on punch and die making. Married; excellent references. For further information write to Box 178.

Mail answers to box number in care of the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Byrom Named V.P.

West Hartford, Conn.—James L. Byrom of Hartford chapter, ASTE, has been elected a vice-president of Niles-Bement-Pond Co.

Mr. Byrom is manager of the Chandler-Evans Div. of his firm.

'Plastics Tooling' Draws Crowd at Season Opening

Indianapolis, Ind.—Ninety members and guests of Indianapolis chapter were on hand September 1 for the opening of the fall meeting season at the Athenaeum.

L. W. Greenblatt, president of Greenleaf Manufacturing Co., St. Louis, Mo., presented the technical subject, "Application and Tooling in Plastic Fabrication."

Through blackboard sketches Mr. Greenblatt illustrated dies and fixtures difficult to describe verbally. He displayed plastic products and explained the tooling required to fabricate the various shapes.

A lengthy question period extending past the regular closing time indicated the members' interest in this fast growing industry.

Pratt & Whitney Photo

Worcester Telegram Photo

Top: A. H. d'Arcambal, a former ASTE president, receives his 30-year service pin from F. U. Conard, president and general manager of Niles-Bement-Pond Co. Below: L. F. Mulno (right), chief engineer of Harrington & Richardson Arms Co., explains details of new repeater shotgun he designed to C. F. Cowdrey, Jr., company president.

Obituary

William F. Georse

William F. Georse, foreman at J. H. Williams & Co., Buffalo, N.Y., passed away this summer in his 73rd year.

A member of Buffalo-Niagara Frontier chapter since 1938, Mr. Georse was educated in his native Buffalo and at Scranton Correspondence Schools.

NBP Honors d'Arcambal On Thirtieth Anniversary

West Hartford, Conn.—Alexander H. d'Arcambal, vice-president and sales manager, Small Tool and Gage Div. and consulting metallurgist of Pratt & Whitney Div., Niles-Bement-Pond Co., recently observed his 30th anniversary with the company.

F. U. Conard, company president and general manager, presented Mr. d'Arcambal with a 30-year service pin. The veteran production executive also received floral tributes and other gifts commemorating the occasion.

Joining Pratt & Whitney in 1919 as chief metallurgist, Mr. d'Arcambal directed metallurgical developments applying to machine tools, cutting tools and gages, as well as metallurgical work for the P & W aircraft engine during the development of that product.

In 1945 he went to Europe as a member of the "metallurgical mission to Germany" to inspect processing used in the Reich cutting tool and gage plants.

A graduate of the University of Michigan, Mr. d'Arcambal is a past president of ASTE and ASM and a member of the American Society for Steel Treating.

Mulno Designs Low Cost Repeating H-R Shotgun

Worcester, Mass.—ASTE nimrods scouring the woods this fall with new shotguns may be using a model from the drawing board of a fellow member.

Lester F. Mulno, chief engineer at Harrington-Richardson Arms Co. and standards chairman of Worcester chapter, ASTE, is the designer of an inexpensive bolt-action 12-gage repeating shotgun which went into production during the summer.

Main feature of the birdgun is that it carries three shells for automatic feeding into firing position on manipulation of the bolt. The low priced repeater is said to sell at one-third the price of multiple-shot shotguns previously available. It is not handicapped by the excessive weight and poor handling qualities usual to bolt-action repeaters in the heavier gages.

In addition to the "Gamester," as the new gun proposed last year by the company's new products committee is known, Mr. Mulno also designed the firm's bolt-action .22 repeater and its single-shot .22 featured in a national mail order catalog.

To Do Rocket Research

Los Angeles, Calif.—James A. Broadston, until recently armament design engineer for North American Aviation, Inc., has begun an assignment as propulsion test group leader for the field laboratory of the company's aerophysics department.

The field laboratory does research and development testing of large rocket motors and propulsion systems.

Mr. Broadston, who is also chief engineer of the Surface Checking Gage Co., is a member of Los Angeles chapter, ASTE, and serves on three ASA committees.

The technical book issue of Publishers' Weekly features the "Tool Engineers Handbook" on its front cover. More than 2800 copies of the new manual already have been ordered from the Society, exclusive of the publisher's sales.

Taylor to Install Officers

Chicago, Ill.—At the October meeting of Chicago chapter, Harold Taylor, a former chairman, will swear in officers-elect of the Allied School of Mechanical Trades student section.

Heading the newly formed ASTE student group will be: R. E. Lingen, chairman; S. G. Fritch, vice-chairman; E. Mechalas, secretary; and M. P. Unitson, treasurer. (Shown below.)

Admiring the end product of a long term ASTE project during a press party for the "Tool Engineers Handbook" at McGraw-Hill Book Co. are from left: H. E. Conrad, ASTE executive secretary; Frank Martindell, Handbook committeeman; Hugh Kelly, senior vice-president, McGraw-Hill Book Co.; R. B. Douglas, ASTE president and Handbook committeeman; A. L. Potter, Handbook committeeman, F. W. Wilson, editor; F. W. Curtis and B. C. Brosheer, Handbook committeemen, and J. J. Wight, McGraw-Hill editor of engineering books.

Trade Editors Approve T.E. Handbook at Press Party

New York City—Already accepted by the profession, the "Tool Engineers' Handbook" was enthusiastically received by the trade press at a publication press party in the offices of McGraw-Hill Book Co., publishers of the Handbook.

Typical of the consensus of approval was one editor's remark: "This handbook has a distinctive pattern of its own and can certainly stand on its own legs."

ASTE President R. B. Douglas, himself a member of the Society's Handbook Committee, outlined for the industrial editors and writers the aims of the Society, objectives sought in compiling the Handbook and its expected impact on the mechanical manufacturing industries.

Review copies of the manual were presented to the periodical and newspaper representatives. The Handbook Committee and publisher's executives concerned received copies autographed by members of these groups.

Present at the affair were: Frank Martindell and B. C. Brosheer of Chicago, Ill., Frank W. Curtis and Adrian L. Potter of Springfield, Mass., all of the Handbook Committee, and Frank W. Wilson, Handbook editor.

Hugh Kelly, senior vice-president, William Larned, vice-president, William Gartner, production manager, John Wight, editor, engineering books, college department; Carl Nagel, editor, industrial and business books, Robert Kelsey, sales manager, International Div., and Herbert Buhrow, manager, mail sales department, all of McGraw-Hill Book Co.

C. O. Herb, editor, *Machinery;* Rupert LeGrand, *American Machinist,* Hartley Barclay, *New York Times;* a Mr. Brown of the *New York Herald Tribune,* and a number of unidentified journalists of the trade and public press.

Later in the day the Handbook Committee entertained the trade press editors and several members of the publisher's staff at dinner.

Here's My Order

Please send the "Tool Engineers Handbook" to the address below as follows:
1 copy @ $11 (ASTE member price); .... copies @ $15 (list price). Payment enclosed in the amount of $..... Orders shipped to Canada will enter the country duty and tax free. Remittance may be made in Canadian funds at the same prices. Shipments to other countries are subject to import regulations.

Name .....

Chapter (if member) .....

Business Title ..... Firm Name .....

Street Address .....

City ..... Zone ..... State .....

Remittance payable to the Society must accompany order. Do not send currency. Mail this order coupon or a facsimile to: American Society of Tool Engineers, Dept. 10, 10700 Puritan Ave., Detroit 21, Mich.

IMPORTANT—In order to obtain the special, member price of $11, orders must be sent to the Society.

Chapter Education Committees Can Advance Professsion By Installing ASTE Technical Institute Courses

As ASTE chapters resume activities and engineering students return to classrooms, the practicing engineers will launch new educational projects to smooth the path of the tyros.

One effective means of promoting tool engineering training is through inaugurating ASTE-approved courses in technical institutes.

A number of chapters already have initiated such a program, but in other areas there are schools that need assistance in organizing or improving tool engineering courses.

To help educate more individuals to take their place in the tool engineering profession, the Society, through its National Education Committee, has formulated and approved a course of study to be administered by technical institutes of recognized standing.

Follows ECPD Recommendations

This curriculum is used as a standard for measuring courses offered in technical institutes desiring ASTE approval. Such institutions submit to the Education Committee information on course content, text material, faculty background and laboratory equipment.

The ASTE yardstick is based upon studies of existing technical institute curricula and upon recommendations made by the sub-committee for technical institutes of the Engineers' Council for Professional Development. It represents the minimum acceptable number of subjects and hours of work.

As a prerequisite to any study of tool engineering subjects, at least two years of shop experience should be required of students employed full time. Students not employed must have had 2000 hours of machine shop practice, foundry work and toolmaking in school laboratories.

Cooperative institutes carry shop and classroom work concurrently, adhering to the same minimum requirements.

The curriculum is expressed in units of time. One unit of work covers: (a) 12 class hours of recitation, or (b) 18 class hours of laboratory. For example, one recitation per week for a 16-week term comprises 1⅓ units. Courses total 96 units, or 1152 class hours, distributed as shown in the tabular breakdown.

In the basic and nontechnical courses, common to all institutions, standard texts are used. For the tool engineering subjects, described below, the Education Committee recommends texts as follows:

Applied Mechanics and Strength of Materials (6 units)—Introduction to statics and kinetics. A study of forces, vectors, moments, center of gravity, moments of inertia, force, mass, acceleration, work, energy, power, strength of materials, stress, tension, compression, shear, torsion, beams, shafts, columns.

Recommended texts: "Applied Mechanics," Brebler, Harper Bros. & Co.; "Strength of Materials," Poorman, and "Practical Mechanics and Strength of Materials," Leigh and Mangold, McGraw-Hill Book Co.

Mechanisms (4 units)—A study of displacements, motions and velocities, elementary principles of simple linkages, gears, cams, flexible connections and intermittent motions.

Recommended text: "Mechanisms," Winston, American Technical Society, 1941.

Breakdown of Manufacturing

Manufacturing Analysis (6 units)—Study of manufacturing methods, methods and parts analysis, operations and operation sequence, operation sheets and bills of material, designing for production, tooling, programs and the economics of tooling, interchangeable manufacture.

Recommended text: "Fundamentals of Tool Engineering," Owen, Prentice-Hall, Inc.

Industrial Organization and Management (4 units)—A study of the fundamental principles of management as applied to organization, costs, personnel, physical facilities, marketing. →

Milwaukee Presents Engineering Scholarship Award

Through the cooperation of the Boys Trade and Technical High School, Milwaukee chapter has awarded a $150 scholarship to promote interest in tool engineering. The award was presented recently to Donald Van Amee of Milwaukee by A. C. Gudert (second from left), chapter chairman. Looking on are Robert Bodendorfer (left) of the education committee and F. W. Ziegenhagen (right), principal of the school.

ASTE Approved Tool Engineering Curriculum for Technical Institutes

Basic Courses

Mathematics, through trigonometry	8 units
Physics: mechanics, heat and electricity	8 units
English, including technical report writing	4 units
Engineering Drawing	12 units
Industrial Materials and Processes	8 units
Total	40 units

Nontechnical Courses

Economics	3 units
Psychology	3 units
Total	6 units

Tool Engineering Courses

Applied Mechanics and Strength of Materials	6 units
Mechanisms	4 units
Manufacturing Analysis	6 units
Industrial Organization and Management	4 units
Manufacturing and Tool Costs	4 units
Tool Design	16 units
Production Procedures	6 units
Process Engineering	4 units
Total	50 units
Total for Course	96 units

Recommended text: "Industrial Management," Knowles & Thompson, Macmillan, 194-

Manufacturing and Tool Costs (4 units)—Manufacturing costs, burden distribution, standard costs, tool cost estimating.

Recommended texts: "Fundamentals of Tool Engineering," Owen, Prentice-Hall, Inc.; "Managerial Control," Glover and Maze, Ronald Press.

Tool Design (16 units)—Tool design standards, design of cutting tools, jigs, fixtures, press dies, gages.

Includes Society's Text

Recommended texts: "Tool Design," Donaldson and LeCain, Harper Bros.; "Tool Design," Cole, American Technical Society; "Jig and Fixture Design," New York State Vocational and Practical Arts Association and American Society of Tool Engineers.

Production Procedures (6 units)—Study of production control, materials control, scheduling, dispatching, materials handling, motion and time study, layout of production equipment.

Recommended texts: "Production Engineering," Buckingham, John Wiley & Sons; "Plant Production Control," Koepke, John Wiley & Sons; "Production Control," Bethel, Tann, Atwater and Rung, McGraw-Hill Book Co.

Process Engineering (4 units)—Development of processes for high production including methods, tools, machine tools, elementary metallurgy.

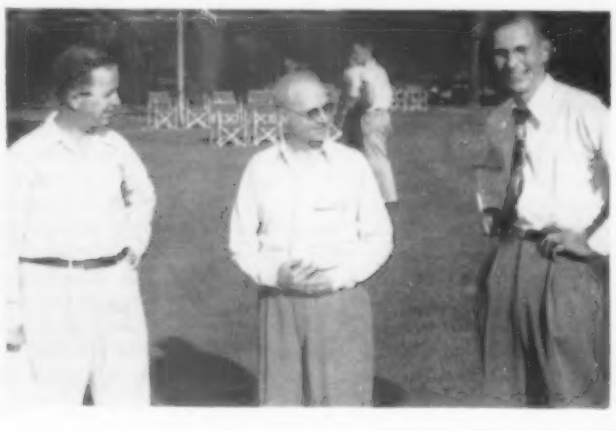
Recommended texts: "Production Line Technique," Mulker, and "Technique of Production Processes," Connelly, McGraw-Hill Book Co.

When a school has complied with the requirements of this curriculum, the Society awards a certificate indicating official approval.

For further information and assistance in introducing the approved curriculum in local schools, chapter education chairmen may contact their national chairman, Prof. Jay N. Edmondson, Production Div., Industrial Engineering, Ohio State University, 212 Engineering Bldg., Columbus, Ohio.

Win at Golf Tournament

Left: These are the Chicago ASTE golf champs who carried off prizes at the chapter's first annual tournament this summer. Right from left: W. E. Burke, program chairman, who organized the event; T. C. Barber, first vice-chairman; and H. V. Loeppert, treasurer.



What **A.S.T.E.** *Means To At-Large Members*

While chairman of the 1948-49 National Membership Committee, Fred J. Dawless of New Haven chapter conducted a survey of At-Large members around the world to learn why they value their membership and how the Society could extend its services to them. The following are typical of their replies.

Dear Sir:

What does ASTE membership mean to me? Thinking deeply about this question, my thoughts go back to the time when I made my application for Society membership.

I was originally trained as a toolmaker and afterwards filled various posts in the factory where I was trained. I had noticed that many of the best machines came from the United States of America. By machines I do not mean toolroom machines only. Such equipment of American manufacture as printing machines, automatic can making machinery, presses both automatic and otherwise seemed to me to be supreme in their classes.

Reads ASTE Paper, Joins Society

I had never known of any organization for the furtherance of tool engineering. Then, in a technical periodical, I read an extract of a paper read at an ASTE meeting.

You can imagine me thinking "I wonder if my standard of training and education is good enough for me to become a member of any grade of this society, so that I can read and learn how tool engineers of some of the best factories in the world go about their work."

Now that I have had the privilege of reading many *Tool Engineers* and have perused many data sheets what are my views?

1. I regard the Society as my telescope for viewing the heavens of tool engineering, bringing new and old stars of the toolmaking world into my view.

2. Although the Society would like to help me, what can I do to help the Society "without teaching my tool engineering grandfathers to suck eggs"?

3. I value, too, the information about fellow members, their families and their parties, as much as I do the technical data.

4. I like to read about and follow with a map the journeys of members, in special trains, to convention cities. In this process I get a little idea of the enthusiasm of members in traveling so far.

5. On two occasions I have written to "Andy" asking questions and also for information. He has done his utmost to help me, replying immediately.

Would Like Convention Papers

6. In the *Tool Engineer* writeup before a convention I see a list of speakers and their subjects. I think it is correct to say that these papers are not always published in *The Tool Engineer;* nor is there always an indication of whether copies of the papers are available to members. It would help if members-at-large could check a list of these papers and write for those they need.

I have received and answered a letter from William Sjostedt of Sweden, so your sending the list of members-at-large has already borne fruit.

Generally speaking, the information which you "put over to us" gives us a very good picture of the American Way of Life. No doubt, as the members-at-large get underway, we shall be able to give details of things which may interest the bulk of members. Although sometimes in far-off countries where good equipment is not always available, there isn't much to write home about.

Pumstead, Cape Province
South Africa

* * *

Dear Sir:

Honoring your request, I will try to explain what I obtain from being associated with our Society as a member-at-large.

In the first place, I feel privileged to be a member of an organization with so many technically trained men. *The Tool Engineer* every month to me means just as much as the funnies to a kid on Sunday morning, as I go over it thoroughly.

I have over 30 years of practical ex-

perience including machine shop, tool room, and toolroom supervision, the last four years in metal pattern making.

When I completed grade school, I was forced to start earning a living to keep my widowed mother. I studied textbooks relating to my various jobs, improving my technical and practical knowledge.

In any organization young blood is essential. Therefore, if this Society had a list of technical advisors available through correspondence for information in their respective fields, I believe that more apprentices and journeymen would become members-at-large in ASTE.

If there are any members in or near Bedford, I would be pleased to hear from them as I like to talk shop.

Bedford, Ind.

Jet Experts Discuss Rocket Motor Tooling

Los Angeles, Calif.—How experimental jet motors were tooled for the WAC Corporal rocket was recently revealed to Los Angeles chapter by two staff members of the California Institute of Technology.

R. E. Moulton, production manager of the jet propulsion laboratory, and Jason H. Walker, coordinator of the same laboratory, were the technical speakers at a meeting held August 11.

In machining the first "heavy" motor from bar stock, Mr. Moulton explained, cams were used to guide the cutting tools for inside and outside surfaces of the inner and outer shells and for the intervening spiral fins. These fins provide a circuitous passage for one of the two fuels, which serves also as a coolant.

R. E. Moulton (left) and J. H. Walker of the jet propulsion laboratory, California Institute of Technology, tell Los Angeles members how experimental jet motors for rockets are tooled. P

A color film, made both by automatic and hand operated cameras, showed in regular and slow motion the launching of the rocket up a 100-ft tower. Telephoto lenses followed it on to the point where recording instruments were released by parachute.

Mr. Walker related tooling problems and progress in developing a lighter motor weighing less than a quarter of the original model. Inner shell halves are formed of approximately 0.064 in. material, while 0.025 in. is used for the outer casing.

The latter has a spiral bulge with a minute flat space between each "thread." Tiny overlapping spotwelds in this space join the two shells. As explained by Mr. Walker, an ingenious combination of pressed steel cups welded together forms separate manifolds for fuel.

Photo copyrighted by The Detroit News

It's easy for Terry Chapman to put his electric train away. He just pushes it up to the ceiling with the hoist designed and constructed by his father, Wiley Chapman (inset), proprietor of Detroit Service Engineering Co. and a Detroit chapter member.

Chapman Builds Hoist to Lift Electric Train Setup

Detroit, Mich.—Like most families impeded by an electric train, the Wiley Chapmans found it a problem.

Mr. Chapman stumbled over the tracks and rolling stock in the living room; Mrs. Chapman stooped wearily to move them whenever she cleaned the room; and five-year-old Terry found the chore of setting up and disassembling his railroad offset his fun in playing with it.

Applying tool engineering to the situation, the senior Chapman, owner of Detroit Service Engineering Co., came up with a hoist design.

The Detroit chapter member, who is secretary and a director of the National Association of Engineering Companies, constructed a wooden base large enough to set up the railway, ran telescopic tubes through a hole in the center of the platform and permanently mounted the equipment on it.

Weight Suspended in Attic

The tubes go through an opening in the ceiling. A cable attached to the train layout passes through the tubes to the attic. Fastened to the opposite end of the cable is a weight counterbalancing the approximately 250 pounds of train, tracks, stations, signals, bridges, automatic switches, houses, trees, telephone poles and mounting. This makes the set rigid enough so that Terry can climb on the platform to play.

A false bottom, removable in four sections, permitted wiring electrically controlled accessories.

When Terry tires of his toy, he can push it up to the ceiling out of the way. A handle on the underside facilitates raising and lowering the installation. But when company comes, the young railroader doesn't show a chance of getting at his train. The new setup fascinates visitors since they can adjust it to their own height and operate the scale model without sprawling on the floor.

Obituaries

Harry G. Carlberg

Harry G. Carlberg, 48, sales engineer for W. F. & John Barnes Co., Rockford, Ill., succumbed recently to illness at St. Barnabas Hospital, Minneapolis, Minn.

A native of Rockford, Mr. Carlberg attended the public schools there. He had served several terms as treasurer of Rockford chapter, where he was active on committees. At the time of his death he was third vice-chairman.

* * *

William P. Maines

William P. Maines, a member of Buffalo-Niagara Frontier chapter since 1917, died August 17 at Glendale, Calif.

Mr. Maines was born at Osceola Mills, Pa., in 1889 and was educated in the Erie schools.

For many years he was superintendent of Sterling Engine Co. Earlier he served as general manager of the King Mfg. Co., also of Buffalo. More recently he had headed William P. Maines Machine Co. of Silver Creek, N.Y.

Directory of A.S.T.E. Chapter Chairmen

AKRON, NO. 47
Second Monday *
Theodore S. Mutto, *Chairman*
Republic Stamping & Enameling Co.
Bedford Ave., S.W.
Canton, Ohio

ATLANTA, NO. 61
Third Monday *
Charles M. Jenkins, *Chairman*
1229 University Dr., N.E.
Atlanta, Ga.

BALTIMORE, NO. 13
Wed. after 1st Mon. *
Andrew J. Jones, *Chairman*
3715 Ridgecroft Road
Baltimore 6, Md.

BINGHAMTON, NO. 35
Wed. after 1st Mon. *
Dean H. Erlenmeyer, *Chairman*
2107 Tracy St.
Endicott, N. Y.

BOSTON, NO. 33
Second Thursday *
Joseph P. Crosby, *Chairman*
38 Highland Ave.
Lexington 73, Mass.

BUFFALO-NIAGARA FRONTIER, NO. 10
Second Wednesday *
Erwin A. Slate, *Chairman*
1 Maplewood Dr.
Gasport, N. Y.

CEDAR RAPIDS, NO. 71
Third Wednesday *
John L. Stark, *Chairman*
Advance Service
111 2nd St., N.E.
Cedar Rapids, Iowa

CENTRAL PENNSYLVANIA, NO. 22
Third Thursday *
Charles F. Stephenson, *Chairman*
888 E. Market St.
York, Pa.

CHICAGO, NO. 5
Second Tuesday *
Anton J. Schwister, *Chairman*
2017 N. 77th Ct.
Elmwood Pk., Ill.

CINCINNATI, NO. 21
Second Tuesday *
Henry Bruewer, *Chairman*
6523 Iris Avenue
Cincinnati, Ohio

CLEVELAND, NO. 3
Second Friday *
Glenn A. Hier, *Chairman*
8024 Ackley Rd.
Parma 9, Ohio

COLUMBUS, NO. 36
Second Wednesday *
W. Kenneth Armagost, *Chairman*
2868 N. High St.
Columbus 2, Ohio

DAYTON, NO. 18
Second Monday *
Gordon Letsche, *Chairman*
146 Hadley Rd.
Dayton 9, Ohio

DECATUR, NO. 58
Last Tuesday *
Charles Hobbs, *Chairman*
1638 N. Maple Ave.
Decatur, Ill.

DENVER, NO. 77
First Wednesday *
James R. Matthew, *Chairman*
3423 E. 29th Ave.
Denver 5, Colo.

DETROIT, NO. 1
Second Thursday *
Monta O. Cox, *Chairman*
9562 Longacre Ave.
Detroit 27, Mich.

ELMIRA, NO. 24
First Monday *
Patrick G. Pecoraro, *Chairman*
350 Riverside
Elmira, N. Y.

ERIE, NO. 62
First Tuesday *
Archie E. Weingard, *Chairman*
3012 Wayne St.
Erie, Pa.

EVANSVILLE, NO. 73
Second Monday *
Walter P. Schneider, *Chairman*
525 Lewis Ave.
Evansville 14, Ind.

FAIRFIELD CTY., NO. 6
First Wednesday *
Meredith W. Wilterdink, *Chairman*
RFD #1
Westport, Conn.

FOND DU LAC, NO. 45
Second Friday *
Allan L. McKay, *Chairman*
Rte. 1
W. DePere, Wis.

FORT WAYNE, NO. 56
Second Wednesday *
John F. Davis, *Chairman*
2946 Plaza Dr.
Ft. Wayne, Ind.

FOX RIVER VALLEY, NO. 72
First Tuesday *
Burt J. Phillips, *Chairman*
802 Augusta Ave.
Elgin, Ill.

GOLDEN GATE, NO. 28
Third Tuesday *
James V. Coulter, *Chairman*
Coulter Steel & Forge Co.
1498 67th St.
Emeryville, Calif.

HAMILTON, NO. 42
Second Friday *
George Gilmour, *Chairman*
1 Hillside Ave.
Dundas, Ont.

HARTFORD, NO. 7
First Monday *
Clayton S. Parsons, *Chairman*
J. K. Smit & Sons, Inc.
10 N. Main St.
W. Hartford 7, Conn.

HOUSTON, NO. 29
Second Tuesday *
Paul E. Brainard, *Chairman*
255 Fauna
Houston 12, Texas

INDIANAPOLIS, NO. 37
First Thursday *
Howard W. Curfman, *Chairman*
317 N. Holmes Ave.
Indianapolis 22, Ind.

KANSAS CITY, NO. 57
First Wednesday *
Samuel M. Waas, *Chairman*
4119 Highland
Kansas City 4, Mo.

LITTLE RHODY, NO. 53
Third Wednesday *
Delbert C. M. Krahnke, *Chairman*
20 Shortway Rd.
Cranston 10, R. I.

LOS ANGELES, NO. 27
Second Thursday *
R. Gerald Stronks, *Chairman*
4225 Irving Pl.
Culver City, Calif.

LOUISVILLE, NO. 54
Second Wednesday *
Norwood H. Booker, *Chairman*
3125 Eagle Pass
Louisville 13, Ky.

MADISON, NO. 75
Tues. after 1st Mon. *
Vern McFair, *Chairman*
3506 Lake Mendota Dr.
Madison, Wis.

MID-HUDSON, NO. 74
Second Tuesday *
Joseph L. Petz, *Chairman*
11 Meadow Rd.
Poughkeepsie, N. Y.

MILWAUKEE, NO. 4
Second Thursday *
Arthur C. Gudert, *Chairman*
R. #7, Box 150
Wauwatosa 13, Wis.

MOHAWK VALLEY, NO. 78
Last Tuesday *
Ernest J. Masucci, *Chairman*
141 Genesee St.
New Hartford, N. Y.

MONTREAL, NO. 50
Second Thursday *
Marc A. Cote, *Chairman*
460 Merton Ave.
St. Lambert, Que.

MUNCIE, NO. 70
Second Wednesday *
Charles L. Marker, *Chairman*
1301 S. Beacon St.
Muncie, Ind.

NASHVILLE, NO. 43
Fourth Friday*
Sidney W. Stowell, *Chairman*
Box 45
Donelson, Tenn.

NEW HAVEN, NO. 41
Second Thursday *
Gerard P. Schoeller, *Chairman*
Marlin Firearms Co.
85 Willow St.
New Haven 11, Conn.

NEW ORLEANS, NO. 60
Second Wednesday*
Carl N. Hazlewood, *Chairman*
6574 General Haig St.
New Orleans 19, La.

NEW YORK, GREATER, NO. 34
First Monday *
Julius Schoen, *Chairman*
1015 Grand Concourse
New York 52, N. Y.

NIAGARA DISTRICT, NO. 65
First Thursday *
Norman B. Coleman, *Chairman*
13 South Dr.
St. Catharines, Ont.

NORTH TEXAS, NO. 51
Second Friday *
Ephrem L. Minch, *Chairman*
613 Edgefield Rd.
Ft. Worth 7, Texas

NORTHERN NEW JERSEY, NO. 14
Second Tuesday *
John E. Epprecht, *Chairman*
RFD 1, Parsippany Blvd.
Boonton, N. J.

PEORIA, NO. 31
First Tuesday *
Harold E. Schmidt, *Chairman*
1016 Miller St.
Washington, Ill.

PHILADELPHIA, NO. 15
Third Thursday *
Emil Kitzman, *Chairman*
3128 Princeton Ave.
Philadelphia 24, Pa.

PITTSBURGH, NO. 8
First Friday *
Frank T. Boyd, *Chairman*
1615 Broad St.
Greensburg, Pa.

PONTIAC, NO. 69
Third Thursday *
Cash Bond, *Chairman*
2 Delaware
Pontiac 18, Mich.

PORTLAND (MAINE), NO. 46
Fourth Friday *
Eldon L. Wishart, *Chairman*
63 Glenwood Ave.
Portland 5, Me.

PORTLAND (OREGON), No. 63
Third Thursday*
Lewis R. Ellingwood, *Chairman*
7714 S.E. 17th Ave.
Portland 2, Ore.

POTOMAC, NO. 48
Thurs. after 1st Mon. *
Harry Springer, *Chairman*
220 E. Windsor Ave.
Alexandria, Va.

RACINE, NO. 2
First Monday *
G. W. Christiansen, *Chairman*
2512 Mitchell St.
Racine, Wis.

RICHMOND, NO. 66
Second Tuesday *
Paul C. Hermansdorfer, *Chairman*
42 S. 12th St.
Richmond, Ind.

ROCHESTER, NO. 16
First Monday *
William R. Gordon, *Chairman*
125 Monteroy Rd.
Rochester 10, N. Y.

ROCKFORD, NO. 12
First Thursday *
Karl B. Kaiser, *Chairman*
1928 N. Rockton Ave.
Rockford, Ill.

SAGINAW VALLEY, NO. 68
Third Thursday *
Harold A. DeVore, *Chairman*
2215 Begole St.
Flint 4, Mich.

ST. LOUIS, NO. 17
First Thursday *
William G. Callies, Jr., *Chairman*
Modern Screw Prod. Co.
2307 N. 9th St.
St. Louis 6, Mo.

SAN DIEGO, NO. 44
Second Tuesday *
Glave S. Bunch, Jr., *Chairman*
7884 Broadway
Lemon Grove, Calif.

SCHENECTADY, NO. 20
Second Thursday *
Fred L. Kinum, *Chairman*
General Electric Co.
Bldg. 28—305
Schenectady 5, N. Y.

SEATTLE, NO. 39
Second Tuesday *
Harold R. Pinkerton, *Chairman*
651 W. 51st St.
Seattle 7, Wash.

SOUTH BEND, NO. 30
Second Tuesday *
Paul Beeler, *Chairman*
R. R. #1
Bristol, Ind.

SPRINGFIELD (ILLINOIS), NO. 64
First Tuesday *
William P. Fronmuller, *Chairman*
2420 S. 13th St.
Springfield, Ill.

SPRINGFIELD (MASS.), NO. 32
Second Monday *
Daniel B. Wesson, *Chairman*
55 Stockbridge St.
Springfield, Mass.

SPRINGFIELD (OHIO), NO. 76
Fourth Thursday *
Roy H. Mumma, *Chairman*
738 Patrick Rd.
Springfield 52, Ohio

SYRACUSE, NO. 19
Second Tuesday *
Fay Adkinson, *Chairman*
108 Hillsboro Pkwy.
Syracuse 3, N. Y.

TOLEDO, NO. 9
2nd and 4th Wednesday *
Rolland H. Mogle, *Chairman*
3722 Leybourne Ave.
Toledo 12, Ohio

TORONTO, NO. 26
First Wednesday *
Frederick J. Crook, *Chairman*
104 Thompson Ave.
Toronto 18, Ont.

TRI-CITIES, NO. 23
First Wednesday *
Donald A. Wangelin, *Chairman*
2042 43rd St.
Rock Island, Ill.

TWIN CITIES, NO. 11
First Wednesday *
Raymond L. Martin, *Chairman*
4248 10th Ave. S.
Minneapolis 7, Minn.

TWIN STATES, NO. 40
Second Wednesday *
Lee M. Davis, *Chairman*
61 Elm St.
Springfield, Vt.

WESTERN MICHIGAN, NO. 38
Second Monday *
John T. Maghielse, *Chairman*
1430 Garfield N.W.
Grand Rapids 4, Mich.

WICHITA, NO. 52
Second Wednesday *
William F. Grabendike, *Chairman*
406 N. Bluff
Wichita, Kansas

WILLIAMSPORT, NO. 49
Second Monday *
Edwin H. Sears, *Chairman*
1356 Mansel Ave.
Williamsport, Pa.

WINDSOR, NO. 55
Second Monday *
William A. Thomas, *Chairman*
Ford Motor Co. of Canada, Ltd.
Tool Design Dept., Plant 2
Windsor, Ont.

WORCESTER, NO. 25
First Tuesday *
Carl D. Schofield, *Chairman*
1 Reynolds St.
Worcester 6, Mass.

* CHAPTER MEETING NIGHT

TOOLS OF TODAY

"Preview"—DoALL Introduces the Contour-Matic

As a "preview" to its showing at the National Metals Congress in Cleveland, this month, the DoALL Company of Des Plaines, Ill., announces a semi-automatic, hydraulically controlled machine tool designed to provide fast, precision cutting of materials through a repetitive production cycle easily controlled by the operator. The machine has a throat of 20 in. and material thickness capacity from zero to 12 in.

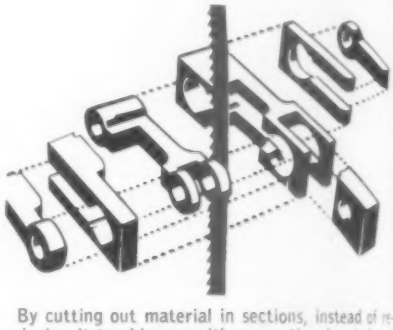
Called the DoALL Contour-Matic, this machine employs an endless belt of cutting teeth to slice through material so that, instead of reducing it to chips as with conventional metal cutting tools, it removes it in sections. As a result, there is a marked reduction in waste and an even more marked saving in material since the cut-out sections are salvable and may be diverted to other uses, as suggested in the smaller illustration.

The Contour-Matic is a development of the basic contour sawing, filing and polishing machine which, brought out by DoALL about fifteen years ago, employed narrow saw bands to cut directly to layout lines. As a natural corollary, the company began to develop basic types of saw blades with which to expand the usefulness of the machine. Between the thirteen basic types of blades so developed it became possible to cut practically any known material used in the metal cutting industries, glass included.

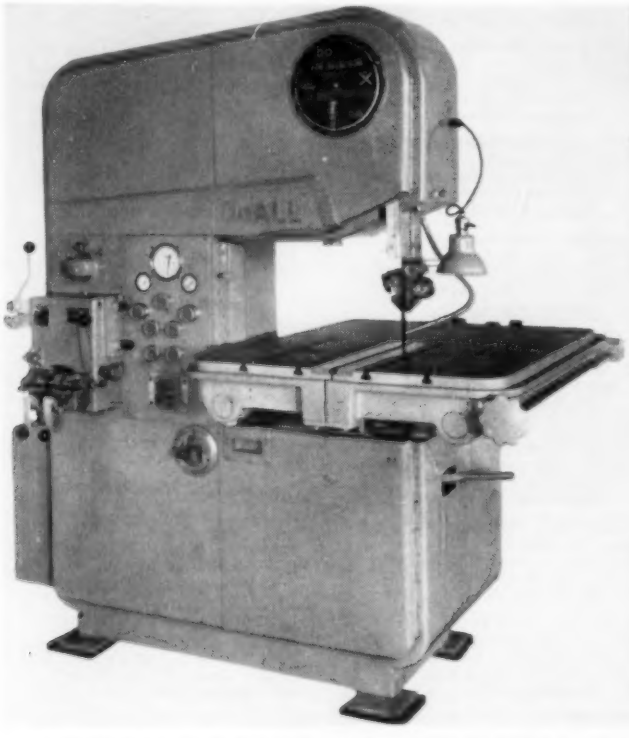
However, operation of these machines on a high production basis required skilled operators, conversant with hand feeding techniques and further adept in the use of special fixtures and attachments. In direct contrast, the Contour-Matic is engineered for fast, efficient semi-automatic operation by apprentices or comparatively unskilled operators.

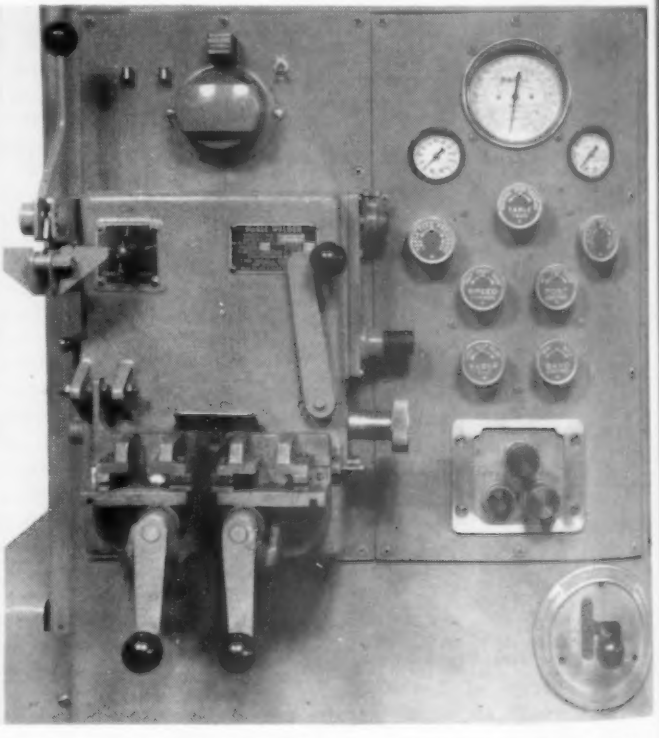
Chief among the many features claimed for this machine is the dial control of hydraulic power used for its operation. After ascertaining from the job selector the correct blade velocity, feeding pressure and type required for a specific material, and selecting and mounting the proper blade, the operator is merely required to push the machine starting button and to position the gear shift lever for the desired speed range. Then, watching a dial speed indicator, he turns a hydraulic control valve to make adjustments for the exact velocity wanted. As, for example, 60 fpm for thick sections of steel, 7,000 fpm for wood and 5,000 fpm for glass.

The machine is said to incorporate all necessary elements for safe operation. Built-in equalizing factors provide for adjustments that are so inter-related that, should anything go wrong, the machine won't start. Nor can it be absentmindedly started with the saw slack; conversely, automatic controls stop the machine in case of saw breakage and both saw carrier wheels are immediately braked to a stop. T-10-1



By cutting out material in sections, instead of reducing it to chips as with conventional metal cutting, the "cored-out" sections may salvaged and diverted to other uses, as illustrated above. This is but one of the many savings to be effected with contour cutting.





Shown at left is the DoALL Contour-Matic. The table, which has 16 in. travel, also tilts both ways to permit compound angle cutting. Correct speeds and feeds for any material can be determined from the Job Selector, shown on the upper door. Blade guides are brought into position by rotating turrets mounted above and below the work table. Shown at right is the operating panel, at the left of which may be seen the automatic flash welder which, together with the closely adjacent shear and grinder, provides for quickly joining all blades from 1/8 to 2 inches.

Lapping and Testing Kit

The Van Keuren Co., 176 Waltham St., Watertown, Mass., announces a micrometer lapping and testing kit—No. 45—offered as an excellent means for machinists and toolmakers to maintain the original accuracy of micrometers.

The kit is designed for lapping and testing micrometers with a range of from 1 to 2 in. and, as claimed, makes it possible to lap the micrometer anvil and spindle surfaces flat and square with the axis of the screw within .000001 in. The kit consists of the following equipment: One 1.0000 in x 1¼ in. dia. double surface lap, accurately flat and parallel within 0.000005 in.; one 1.0125 in. x 1¼ in. dia. double surface lap accurately flat and parallel within 0.000005 in.; one 3/16 in. and 1/4 in. ball tester; and two drams of finish lapping compound.

The object of using two thicknesses of laps is to secure measuring surfaces

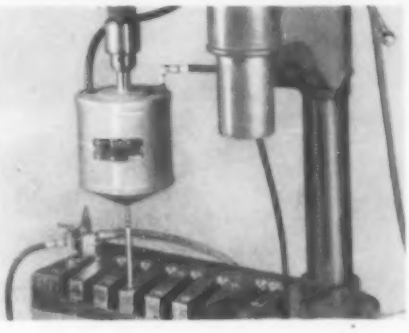
which are square with the axis of the spindle. With a 1.000 in. lap only, the surface might be lapped parallel but at a slight angle to the axis of the spindle. This condition is corrected by the use of the 1.0125 in. lap which causes the spindle to be at the half turn position. The ball tester will show the condition of flatness and parallelism of the measuring surfaces and will detect an error as small as 0.00001 in.

Kit No. 45A and 45B consist of the same equipment, the former with an additional 1.000 in. lap to be used for micrometers with a range of from 2 to 3 in. The latter is furnished with 1/4 and 3/16 in. laps and is designed for micrometers with a range of from 0 to 1 in. Circular M34 with complete instructions and illustrations showing the use of the kits is furnished with each set. **T-10-2**

CORRECTION

In September issue, Item T-9-15, Angle Precision Vise, the name of the manufacturer was incorrectly stated at Natco Tool Company. It should have read MATCO TOOL COMPANY.

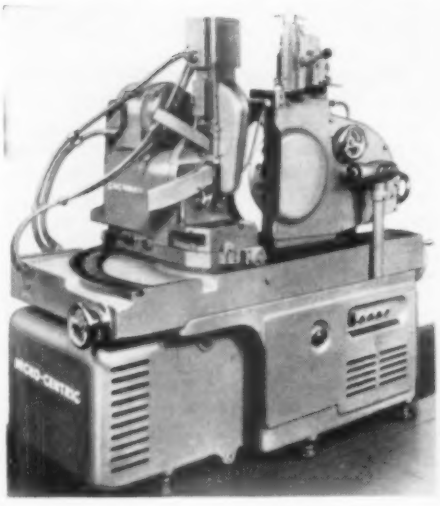
Cutting Solution by Elox

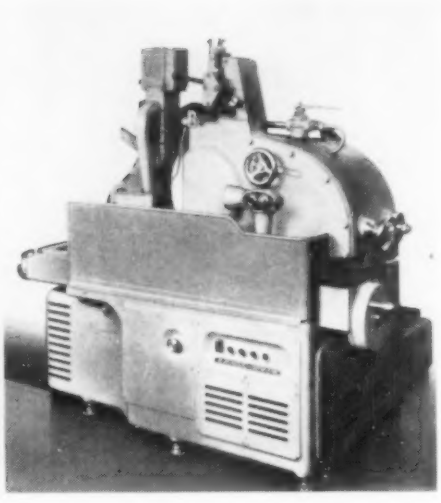


The Elox Corp., 740 N. Rochester Rd., Clawson, Mich., announces a Cutting Solution, for use with Elox Disintegrators, which is said to speed removal of broken tools and cutting of holes in hardened parts.

Where water alone is used, there are cases where broken taps or drills cannot be removed profitably. For example, it may take 30 minutes to remove a ¼-20 tap from a steel casting. But by adding Elox Cutting Solution concentrate in correct proportion, the average cutting time may be reduced to 10 minutes or less. **T-10-3**

Micro-Centric Grinding Machines by Cincinnati





A high production Grinding Machine —the Micro-Centric—has recently been developed by Cincinnati Grinders Inc. Designed primarily to meet the requirements of the precision anti-friction bearing industry, this machine can also be used for numerous parts requiring similar standards of accuracy. Employing a novel principle of work support and rotation, the machine is said to easily hold roundness well under 0.000025 in. without centers or a chuck. The work is located, rotated and supported in such a manner that the ground diameter can also be held square with a pre-finished face well under the stated accuracy.

The machines are made in two sizes —No. 1 and No. 2—and either can be built for full automatic operation or for hand loading. The No. 1 machine will grind work diameter from ¾ to 3-½ in., either automatic or hand loading, while the No. 2 machine will handle pieces from 2 to 4 in. diameter with automatic loading, or 2 to 8 in. diameter when hand loading. Pieces above 4 in. diameter can usually be handled faster and more efficiently with hand loading than with automatic loading. One operator can feed two to four fully automatic machines or one to two hand loaded machines, depending upon the operation.

Fundamentally, these grinders are built to handle work that has a large diameter in relation to the length. The machines operate by a unique method wherein the grinding wheel head, pivoting on a trunnion under the wheel spindle, is rocked forward into grinding position through a definite pre-set cycle which develops in four phases: load, rapid advance, feed-and-dwell, retraction-and-unload. Each phase can be individually controlled, and each is flexible and simple to adjust. A well-balanced combination of electrical and hydraulic controls insures rapid response and smooth action.

On standard machines, the headstock and work holding fixture are mounted on a swivel plate that can be adjusted through 90 deg. Thus, the headstock spindle can be set parallel to the grinding wheel spindle or at right angles to it, and any angle in between ground on the periphery of the work-piece. Radically trued or formed grinding wheels allow the grinding of various peripheral shapes.

As an indication of the precision performance of these grinders, it is stated that a typical bearing race was ground to a specific size and its diameter accurately measured. The periphery was then marked with a soft lead pencil and the race returned to the machine for a duplicating grind. The pencil marks are said to have been entirely removed without measurably altering the diameter. Complete information on the Micro-Centric Grinder is contained in Catalog G-573, obtainable by writing to Cincinnati Grinders Inc., Cincinnati 9, Ohio.

T-10-4

Solid Carbide End Mills

A type of End Mill completely formed from solid carbide and developed by the Wendt-Sonis Company, Hannibal, Mo., is designed for production runs on close tolerance slotting and key way cutting operations in cast iron, mild heat treated steels and all types of non-ferrous and non-metallic materials.

Chief feature of this Wendt-Sonis tool is the greater resistance to wear provided by the solid carbide; as a result, these tools may be used repeatedly after being ground to smaller cutting diameters. The solid carbide provides maximum strength and safety in operation, and ample flute length, with smooth contours, allows faster chip removal regardless of depth of cut. The tools are available in straight or spiral flute design in sizes ranging from 3/16 to ⅝ in.

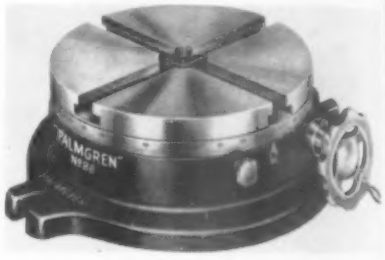
T-10-5

A CORRECTION

In Items T-8-48, August issue, and T-9-40, September issue, respectively a Suspension Tool Balancer and a Welder Gun Balancer, the manufacturer was incorrectly stated as the Blatz Company. These tools are manufactured by the PLATZ COMPANY, 20933 Sherwood Ave., Detroit 34, Mich.

Palmgren Rotary Table

The Chicago Tool and Engineering Company, 8383 So. Chicago Ave., Chicago 17, Ill., announces Model No. 86 as an addition to its line of Rotary Indexing Milling Tables. The unit incorporates an 8 in. diameter table with two ⅝ x 1⅛ in. T-slots crossing at the center. A centrally located reamed hole, 1⅛ in. diameter, takes a locating plug. Base diameter is 9¼ in. with two bolt and key slots for rigid mounting to machinetool tables. Overall height is only 3¼ in.



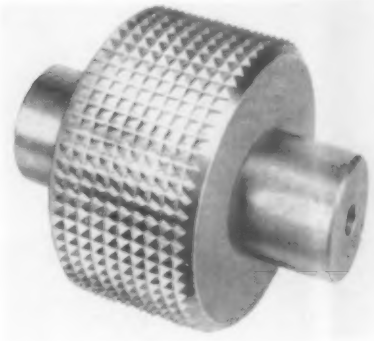
The platen is graduated for the full 360 deg, and a graduated dial on the worm shaft provides for settings to 15 minutes or "in-betweens". Two hold-down clamps, with thumb screws, are also furnished for purpose of table locking after index.

T-10-6

Knurl for Mill Rolls

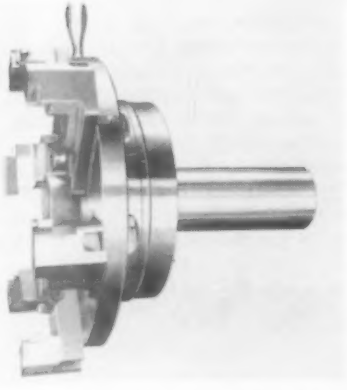
Kennametal Inc., Latrobe, Pa., has developed a Knurling Wheel of solid Kennametal for roughing up the surface of mill rolls. The wheel, made to suit customers' requirements, is supported on a solid Kennametal pin held in the usual fixture. The illustration shows one type of K-M wheel which, because of its great hardness and strength is said to have lasted up to 100 times as long as steel wheels before regrinding was necessary. Further particulars are available from the manufacturer.

T-10-7



Landmatic Die Head for Valve Seat Rings

Landis Machine Company, Waynesboro, Pa., announces an internal-trip type Die Head for threading valve seat rings up to diameters of 14¾ in. Developed by the company's engineering department, this die head is normally furnished without the internal trip when the valve seat rings are chucked and faced in relation to the chuck. This arrangement permits setting the stops on the turret so as to allow the normal pull-off action to trip the die head.

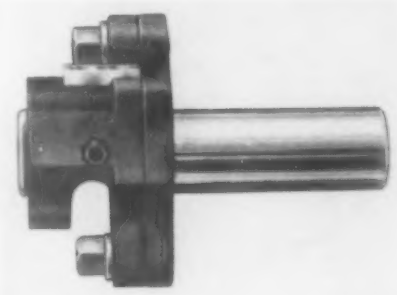


For thread sizes larger than 9-5/16 in. diameter, an enlarged closing ring is mounted on the head to support the oversize chaser holders. Varying thread lengths of different valve seat rings can be taken care of by the height of the oversize holders.

The chasers used—6 per set having a 30 deg short roughing and finishing throat—are said to be very economical in view of their usable length and interchangeability. The coarsest pitch recommended is 8 threads per inch. The chaser holders have a diametrical adjustment of approximately 5/8 in. on the larger size, thus permitting the same chaser holders and chasers to be used for different diameters. **T-10-8**

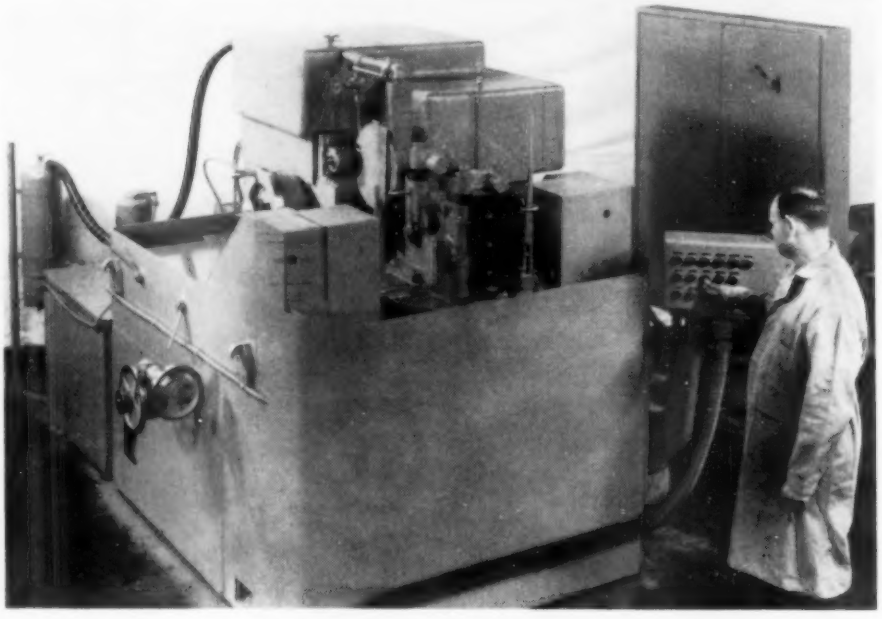
Adjustable Pointing Tool

A Pointing Tool said to relieve the main "headache" in screw machine work—sharp and accurate pointing of turned parts—is announced by Boyar-Schultz Corporation, 2110 Walnut St., Chicago 12.



Made in three sizes—OOAP, OAP and 2AP, 3/8, 5/8 and 7/8 in. capacity respectively—and uinversally adjustable, these tools operate after the manner of a hollow mill. A guide bushing in the nose of the tool, which can be used left or right hand as desired, insures concentricity. The tool is further adjustable to compensate for misalignment between turret and spindle, and rectangular tool bits may be ground with four shapes, much after the manner of form tools. **T-10-9**

Truformatic Contour Grinds 4000 Parts Per Hour



A Truformatic Crush Grinding Machine, developed by the Thompson Grinder Company, Springfield, Ohio, is designed to mass-produce simple or intricate contours in small metal parts with great efficiency. For example, the machine illustrated is said to produce convex and concave finished edges on lock stampings at the rate of over 65 a minute.

The fixtures are pre-loaded with about 160 stampings. The fixture is then loaded onto the indexing table, which has two vertical faces to which the fixtures are attached. The table turns 180 deg and the work is brought into position for grinding; simultaneously, on the other side of the rotating table, the fixture with the finished work is ready for unloading and refilling.

After the original setting this operation is entirely automatic with push-button control of the entire working cycle. The wheel head moves in horizontally to contact with the work on the table, and the indexing table rises to pre-set stroke.

The work is ground in a single pass as the form is transferred from the wheel and ground into the metal parts. The wheel head then retracts and the table returns to loading height and indexes ready for the cycle to repeat. Work table stroke is variable from 3 to 16 inches at any feed rate up to 15 feet per minute and, as the Truformatic can finish 160 parts a cycle, with about 25 cycles being completed each hour, production is thus rated at about 4000 parts per hour. The machines are further available in sizes and capacities to meet various mass-production requirements. T-10-10

A "Cooler" Coolant

Lusol, a concentrate which may be diluted with 25 to 100 parts of water, is said to permit considerably higher turning speeds with carbide tools and to considerably increase tool life. Complete particulars of Lusol, which is said to actually run cooler, may be had from the Anderson Oil Co., Portland, Conn. T-10-11

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T-10-19 T-10-20 T-10-21 T-10-22 T-10-23 T-10-24 T-10-25 T-10-26 T-10-27
T-10-28 T-10-29 T-10-30 T-10-31 T-10-32 T-10-33 T-10-34 T-10-35 T-10-36
T-10-37 T-10-38 T-10-39 T-10-40 T-10-41 T-10-42

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Con-Rod Gaging Machine

Automotive connecting rods may now be gaged completely for all critical dimensions and conditions, stamped with proper classification and suitably segregated at the rate of one every five seconds by an automatic "Airlectric" Gaging, Classifying and Segregating Machine developed by the Sheffield Corp., Dayton 1, Ohio, for one of the larger automobile manufacturers.

Coordinated pneumatic and electrical circuits, together with mechanical actuating devices, are said to make possible the checking of a variety of dimensions and conditions never before attempted on an automatic gaging machine. As, for example, true diameter, average diameter, out-of-round, taper, squareness of face with bore, center distance between holes, width, bend and twist.

Only one operator is required to load the connecting rods on eight continuously rotating individual locating platforms mounted on a turret wheel which indexes in 45 deg stages.

At the first station, the part is presented to a pair of air spindles having several jets. Here, the amount of bend, and also the degree of twist, is measured to a close tolerance. Signals are transmitted to Sta. 2 where, if it has passed the bend and twist check, the rod is retained on the turret. If not acceptable, it is automatically ejected by a pneumatic device and returned by conveyor belt to the straightening bench.

Acceptable parts then index to Sta. 3, where out-of-round and center distance between the holes are gaged. Following this, the width at the large end of the rod is inspected and simultaneously checked with the squareness of the large bore. Next, the large bore receives a Go-Not Go diameter check, the taper of the small hole is gaged and the rod is automatically stamped with one of three 0.0001 in. classifications of the small hole diameter.

Automatic ejection of acceptable parts is made at Sta. 6. Rods rejected at Stations 3, 4 and 5 are not stamped but remain on the carrier wheel to be manually removed by the operator at the end of the turret wheel cycle and just prior to reloading. **T-10-12**

Coil Weight Calculator

A Coil Weight Calculator, devised by the F. J. Littell Machine Co., 4143 Ravenswood Ave., Chicago 13, Ill., permits quick and easy calculation of the exact weight of steel coils. Inside and outside diameters are dialed to get pounds per inch of width. Unit weight is then dialed against the width of stock, and total weight of coil is shown.

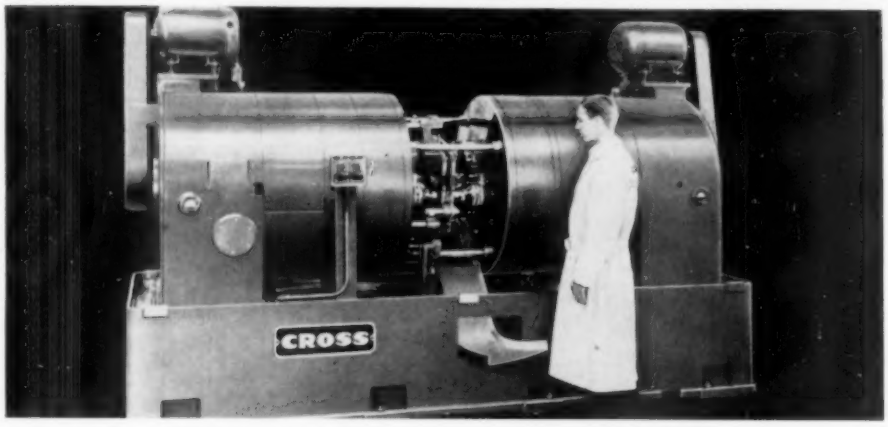
On the back of the calculator is a handy sheet-gage table and a complete listing of all sizes of Littell reels. By using this calculator, the press-room foreman can choose the correct size of reel required for any size or weight of coil. It further permits double checking of coil. It further permits double checking of coil weights shown on bills of lading. As an indication of its speed, it is claimed that it will give the exact weight of a coil four times as fast as it can be computed with the aid of a handbook and slide-rule. One or more of these calculators may be had free on request, mentioning THE TOOL ENGINEER. **T-10-13**

Cimcool Tapping Fluid

The Cimcool Division, Cincinnati Milling Machine Co., announces Cimcool Tapping Company, a companion to Cimcool cutting fluid. This compound is a chemical emulsion in water that can be used as an extreme pressure lubricant or brushed on by hand, as conditions warrant.

Claimed for the compound is that it neither piles up in the machine nor leaves a deposit on the threads, and further eliminates welding of chips to the top. It is recommended for use on all metals, die castings included. **T-10-14**

Machine for Chamfering Connecting Rods



Chamfering connecting rods at the rate of 1,000 pieces per hour with only one operator is claimed for a special machine tool designed and produced by The Cross Company, Detroit 7, Mich.

Since the machine is designed for maximum automaticity, the operator—paced by the continuous automatic cycle—merely loads the parts and presses the cycle button. Unloading onto a conveyor for the next operation is accomplished automatically.

Quality of output is assured by tool heads designed to align the work from the main bore, for perfect concentricity, and by single point carbide tools to generate the chamfers. Other features include complete cam operation and protection against improper loading and off-side parts. **T-10-15**

Indicator Point Selectors

A dial indicator Point Selector, by the L. S. Starrett Co., Athol, Mass., provides a complete selection of the most frequently used contacts. The selection includes 14 standard and special points, all of which have a 4-48 mounting thread to fit any standard American gage design indicator.

The points are securely mounted in tapped holes in an attractive aluminum ring on which is stamped the identifying size or number for each contact. Choice includes a range of 4 standard 13/64 in. diameter points, ¼ to 1 in. long; 9 special shapes for measuring in holes or restricted places; and a shock-absorbing point with an internal spring and telescoping anvil which protects the indicator from blows or sudden shocks. **T-10-16**

Quick-Lock Adapters

Scully-Jones and Co., 1901 So. Rockwell St., Chicago 8, Ill., announces two additions to its standard line which, combined, will be known as the Scully-Jones Quick-Lock Adjustable Adapter Assembly. Listed separately, they are catalogued as the Quick-Lock Nut and the Quick-Lock Adapter.

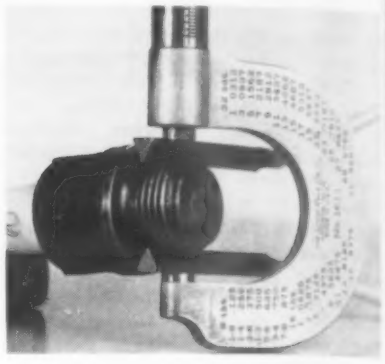
The former is an all-purpose nut designed for speedy and accurate adjustment to 0.001 in. and less. A quarter turn of a set screw instantly wedges its threaded locking shoe against threads without damaging them. Diameter, width and Acme thread conform with ASA, GMC, and Ford standards, and close center distances are possible because diameters regularly are equal to or smaller than those of old-style adapter nuts, which it may replace.

The Quick-Lock Adapter has a continuous American National Acme thread. There are no slots as in former types and, when used with the Quick-Lock Nut, infinite adjustments are possible. It is a superior tool holder, said to provide exceptional rigidity.

The 8 standard quick-lock nut sizes are: ½ to 1 in. by 8ths, 11/16, 1⅜, and 1⅞ in. having No. 1, 2 or 3 Morse taper hole according to size. **T-10-17**

Screw Thread Measure

A system of screw thread measuring, announced by W. T. Simmons, Box 364, Amarillo, Texas, is said to require only ordinary micrometers to measure all sizes and pitches of 60 deg threads. The system is simplicity itself, consisting of a connected pair of hardened and precision-ground triangular steel bars with points truncated to clear the thread roots.

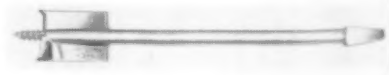


The salient feature of the system is the elimination of formulas for computing proper dimensions when "miking" over the screw and triangles. Only one number, provided by a simple chart of constants, need be added to the nominal O.D. of the thread to get the proper dimensions. However, the constants are so compiled that the screws—pitches from 4 to 56 inclusive—are actually measured at the pitch diameter.

To a 1⅜-18 screw, for example, it is only necessary to add the chart constant for all 18-pitch threads, which is 0.316 in., to the 1.375 in. nominal O.D. The result, 1.691 in., is the proper reading across the thread and triangles for a class 4 fit. **T-10-18**

Auger Bits for Wood

Whitman & Barnes, Detroit 16, Mich., recently announced the manufacture of Auger Bits designed to drill holes with considerably less effort than is required with conventional twist bits. Design also permits the bits to be sharpened on a grinding wheel instead of with special files.

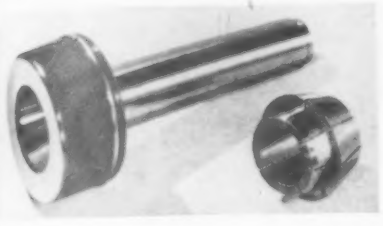


Made from drop forged tool steel and heat treated for increased strength and cutting life, the bits are available in six sizes from ⅜ to 1 in. in increments of ⅛ in. They can be obtained singly or in a rolled kit. **T-10-19**

TURN TO PAGE 56
FOR HANDY
"TOOLS OF TODAY"
COUPON

Centerless Shaft Support

A simple and practical device for use in supporting centerless shafts concentrically in the lathe has been announced by the South Bend Lathe Works, 417 E. Madison St., South Bend 22, Ind. Known as the Adjustable Collet Bushing Chuck, this inexpensive device makes possible easy and accurate centering in the lathe of any shaft ¼ to 1 in. in diameter—as, for example, automobile starter and generator armature shafts that do not have center holes and usually cannot be easily or accurately drilled for centering. However, such shafts can be readily and accurately centered with this device.



The chuck is available with No. 2 or No. 3 Morse Taper Shanks for use in either the headstock spindle or the tailstock spindle of the lathe. Brass collet chucks can be supplied for round stock in sizes from ¼ to 1 in., by 16ths. A special size collet of 0.637 in. round capacity is available for chucking popular types of automobile generator armatures having shafts of this size.

When used in the lathe headstock, the Adjustable Collet Chuck may be adjusted to drive the work or, when used in the lathe tailstock, may be adjusted for an accurate running fit. Further information may be had from the manufacturer. **T-10-20**

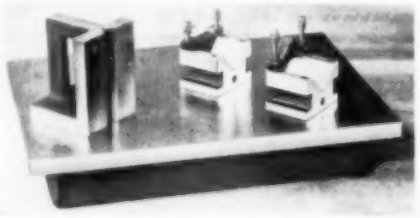
Dry Lubricant

A specially prepared, smooth-textures molybdenum compound powder whose treatment and composition renders it peculiarly adapted for extreme bearing pressure applications, is announced by the Alpha Corp., Greenwich, Conn. Known as Molykote, Type Z, this lubricant is said to have exceptional chemical and thermal stability and inertness, to resist attack of all but a few acids, and to have lubricating characteristics unaffected by temperature from the sub-zero range up to 750 deg F. Another feature claimed is that it has an affinity for tenacious adherence to metal surfaces and a film strength that effectively prevents galling and seizing at bearing pressures in excess of the yield strength of most metals. It is finding increasing use as a wear-in lubricant for dies, gears, and machinery.

It may be applied dry in the powder form or may be mixed with solvents, oils or greases. It is said to excel as a thread lubricant, especially on threaded connections subjected to high temperatures for sustained periods, to effectively prevent freezing of threaded connections, and to be particularly effective for drawing and cold forming stainless steel and other materials. **T-10-21**

Surface Plate and Accesesories

A heavy cast-iron Surface Plate, for laying out work and general toolroom and shop use, is now available from the South Bend Lathe Works, 417 E. Madison St., South Bend 22, Ind. This plate is made of special quality close-grained iron having a high resistance to wear, and is heat-treated to prevent distortion. The surface is precision ground and all edges are accurately machined. Bottom is heavily ribbed and has three point support. The size is 12 x 17 x 3 in. with top ¾ in. thick.



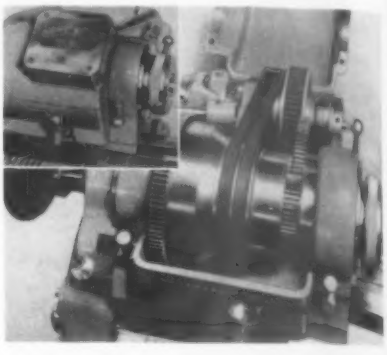
Toolmaker's V-blocks, made of hardened steel with all surfaces precision ground, are also available for use with the surface plate. Supplied in matched pairs only, each block is 2-15/16 in. wide, 1-15/16 in. high, and 2-¼ in. long. Capacity for round work is ¼ to 2 in. in diameter.

Another item for use with the South Bend surface plate is the angle plate, precision ground on six sides. It serves as a square for laying out and setting up work and is ideal for checking and finishing right angle surfaces. Size 3-¼ x 3-¼ x 4-¼ in. with ⅝ in. V-groove. The three items are popularly priced, are available for immediate delivery and may be purchased individually.

T-10-22

Stepless Speed Lathe

Wade Tool Co., Waltham, Mass., announces that its Model 8A Toolmaker's Precision Lathe is now available with stepless spindle speeds from 32 to 2000 rpm, or 32 to 220 rpm with back gears engaged. Powered by a 1 hp motor, the lathe swings 8½ in. and has 1 in. collet capacity.

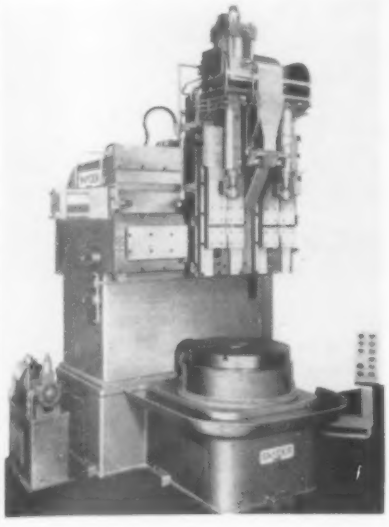


An entirely mechanical variable speed drive incorporates a clutch which permits the operator to start, stop and brake the spindle while the motor is running. An electric tachometer, located on the headstock housing, registers all spindle speeds.

The bed, a hollow square in section, is ribbed for maximum rigidity. Both front and rear guideways are extra wide, with the front way of extra heavy construction and located directly over the supporting side of the bed to obviate chatter during heavy cuts. An additional feature is a case hardened steel block, mounted on the rear station of the compound cross slide, which is designed for longitudinal adjustment and will take cut-off or form tools. T-10-23

Vertical Hydraulic Lathe

Although built for a specific application, a special heavy-duty, Vertical Hydraulic Lathe, by Snyder Tool & Engineering Company, Detroit, is said to be widely adaptable to facing, boring or turning a variety of large work pieces simply by changing the fixtures and tool holders. The machine is designed to obtain maximum efficiency from the use of carbide tooling.

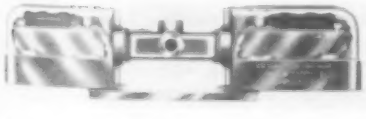


The vertical, welded steel column carries a hydraulically operated, horizontal cross slide upon which are mounted two hydraulically operated vertical tool slides, each equipped with T-slots and keyways for mounting tool blocks and holders. Slides and ways are hardened and ground. Horizontal and vertical slides have 21 in. and 14 in. stroke, respectively; however, horizontal and vertical slides up to 27 and 21 in. strokes could be used.

A 30 in. variable speed, rotating table, mounted in preloaded, Timken bearings and driven through spiral, bevel and helical gears, is equipped with T-slots and pilot for mounting fixtures or chucks. **T-10-24**

Double Solenoid Valve

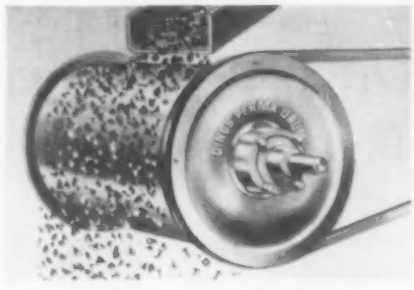
Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio, announces a line of Double Solenoid Valves for air pressures 0 to 125 psi. Sizes of ¼, ⅜, ½ and ¾ in. are offered in the double-solenoid line. All sizes are available for 110, 220, and 440 volts in both 50-60 cycle and 25 cycle current.



The valve has a one-piece bronze base for each solenoid, heavy and powerful solenoids for positive seating and cool operation, heavy sheet metal cover for protection, "OU" type packer and shock-resisting clevis and clevis pin. These models are available in 2-way, 3-way piped exhaust, and 4-way piped exhaust. **T-10-25**

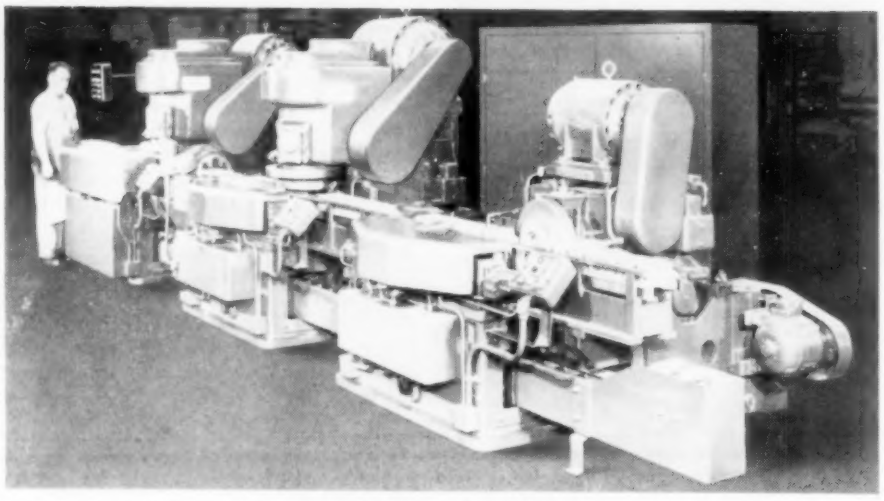
Perma-Drum Magnetic Separator

Dings Magnetic Separator Co., 4740 W. Electric Ave., Milwaukee, Wis., announces a permanent drum-type, non-electric Alnico Magnetic Separator for automatic removal of tramp iron. Complete with shaft and V-belt drive sheave, this magnet can be installed at the discharge end of chutes, spouts and conveyors.



The non-magnetic steel drum shell revolves on sealed, self-aligning ball bearings while the non-electric Alnico magnet inside the drum shell remains stationary. The non-magnetic material flows over the drum shell in a normal trajectory, while the tramp iron, holding fast to the drum by the magnetic pull, drops off when it passes out of the magnetic field. No discharge aids are necessary, and there is no drum shell wear from adherring tramp iron. **T-10-26**

Automatic Transfer Rigidmil by Sundstrand



An automatic Transfer-type Rigidmil, by the Sundstrand Machine Tool Co., Rockford, Ill., mills the top, bottom and both sides of cylinder heads. The machine consists of three milling stations, one turn-over station, an idle station and loading and unloading stations.

As designed, all of the traveling heads are intertimed and none will start the rapid return or shuttling movement until all are ready, thus—as claimed by the manufacturer—making a pile-up of work pieces at any one station impossible. At the first milling station, a 25 HP traveling head with one vertical and one horizontal spindle mills the top and the left side accessory mounting bosses.

At the turn-over station, the piece is turned 180 deg, making the bottom side up. At the next milling station, a 40 HP traveling head with one vertical spindle, mills the bottom—or contact face—of the cylinder head. From the second milling operation, the piece goes into an idle station. This station is necessary to allow room for movement of the two traveling heads on either side.

The last milling station has a 15 HP traveling head with one horizontal spindle that mills the right side. Now, with all four sides milled, the piece moves onto the unloading station and the outgoing conveyor. **T-10-29**

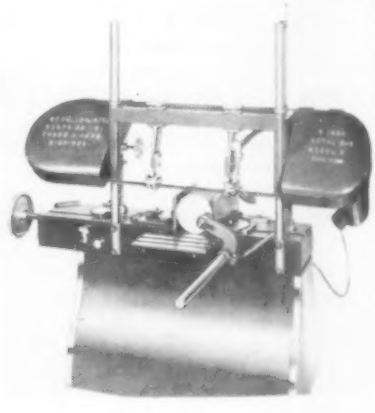
Solid Carbide Boring Tools

To facilitate precision boring of deep holes, Bokum Tool Co., 14775 Wildemere, Detroit 21, Mich., has developed a line of single-point Boring Tools made of solid tungsten carbide. The manufacturer claims greatest possible rigidity in the performance of these new tools, a feature that, added to helical and spiral relief and constant clearance, should spell many advantages to users.

These tools are made in two sections. The shanks are made of a tough grade of carbide having maximum strength, while the heads, made of a carbide having high wear-resisting quality, will take fine cuts without glazing; therefore, they produce fine finishes and hold close tolerances.

Due to the high modulus of elasticity of carbide metal, the tools' shanks are said to be 2.8 times as rigid as steel shanks of the same dimensions. **T-10-27**

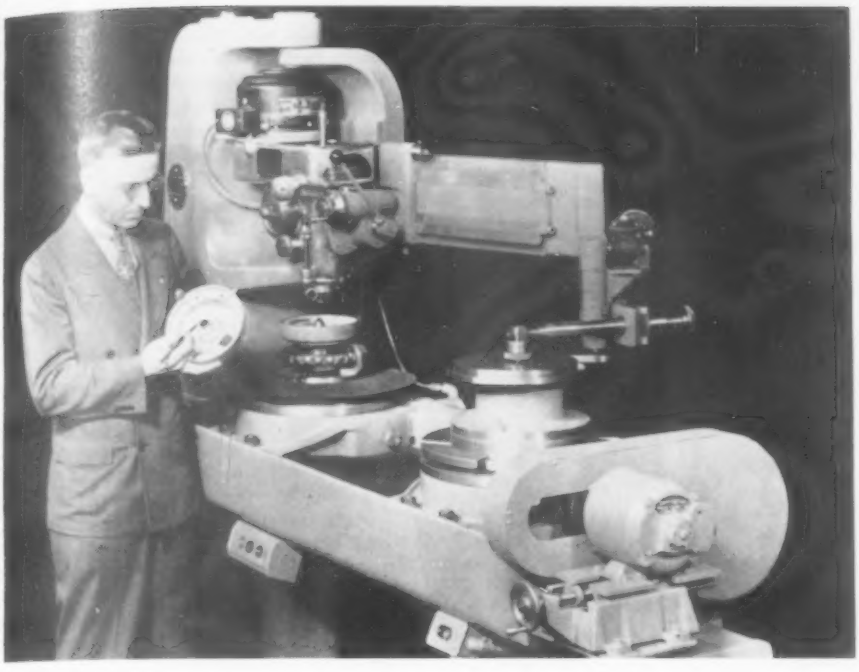
9-In. Metal Cutting Saw



W. F. Wells and Sons, Three Rivers, Mich., announce a 9 in. Metal Cutting Saw having capacity 9 in. x 18 in., with maximum clearance under the blade 20 inches. Designed to fit the requirements of most cutting jobs, the machine is further claimed suitable for various milling, planing and slotting jobs.

A quick action vise, operated by a continuous screw, swivels 45 deg and clamps rigidly. A stock stop automatically recedes at completion of stroke to prevent bind; also, a metering valve provides correct hydraulic pressure in the blade when cutting. When cut is completed the machine will stop at a selected height, or, it may be set for repeat cycle. The machine raises and lowers hydraulically. **T-10-28**

High-Accuracy Cam Profiler



The George Gorton Machine Co., Racine, Wisc., has announced the Gorton Contour Mill No. CM-12, with rotary master, variable ratios and automatic cycling. Basically a tracer-controlled swivel-head milling machine which employs rotary tables, this machine is designed to profile or groove either the inside or outside periphery as well as the top of cams or cam-like shapes to extra close tolerances and with exceptionally high surface high surface finishes.

It is simple, versatile and adaptable, with no complicated electronic, hydraulic or pneumatic controls, and operates at reduction ratios of from 2:1 to 10:1. These reduction ratios make possible its extreme accuracy. Due to its unit construction, the machine can readily be modified to accommodate larger or smaller work.

The machine is designed to profile all conventional cam shapes which do not include negative angles; however, most interrupted cam shapes which lend themselves to continuous cycle profiling can also be accommodated. Numerous other automatic profiling operations are said to be likewise possible.

Operation is rather simple. Two 16-in. roller bearing rotary tables are mounted on the bed of the machine and are geared together and powered by an infinitely variable speed unit which provides the required rpm. The cutter and tracer spindles are mounted, as shown in the larger illustration, on a rugged tracer extension arm. Reduction ratios are set by moving the micrometer bracket to the right or left on this arm according to the calibrations engraved on its face. A lead screw provides for locating the workpiece table under the spindle in its various positions.

During each cycle, all operations are completely automatic. After the workpiece is mounted, a push button turns on all motors and cycle starts. When the cycle is complete, the machine stops without attention. The workpiece shape is generally by the shape of the master and the cutter is fed into the work at a fixed depth by the tracer-feed cam. The Gorton Contour Mill can also be furnished with automatic spindle feed, is desired.

Spindle speeds from 300 to 10,000 rpm are available, the wide range permitting the use of carbide cutters or burrs and, on occasion, grit grinding wheels, in addition to high-speed steel cutters. Adjustment compensates for cutter or grit wheel wear.

Workpiece diameters of the machine illustrated at the various reduction ratios of 2:1, 4:1, 6:1, 8:1, 10:1, are 8, 4, 2.66, 2 and 1.6 inches in the order stated. While the master copy table is 16 in. in diameter, it will accommodate larger diameter master cams with the resulting increase in the maximum diameter of the workpiece. If cam or workpiece is thin, several can be profiled at once by "stacking". **T-10-30**

Electrode Holder

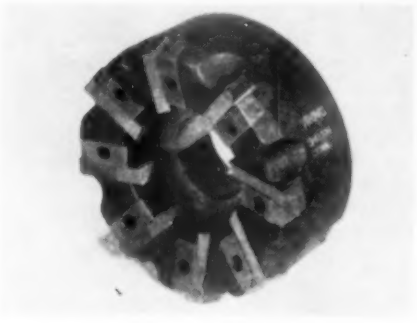
An Electrode Holder—the 6S—by Martin Wells, Inc., 5886 Compton Ave., Los Angeles 1, Calif., is designed for sustained heavy duty welding. Said to be 100% insulated to provide complete safety to both holder and operator, it handles all rods through to $\frac{3}{8}$ in. and

up to 600-700 amps on full duty cycle.

Rods are held by a cam action grip which, designed to instantly release while yet gripping with great pressure, provides excellent contact between rod and holder. Design provides for maximum visibility with comfortable handhold and allows better access to work in close quarters. **T-10-31**

Carbide Face Mill

The Viking Tool Co., Shelton, Conn., has developed a carbide Face Milling Cutter said to combine the stock removal qualities of brazed-on and serrated-blade-tipped cutters with the economical regrinding features of solid carbide-bladed face mills. The main feature of the tool is a large carbide tip with just sufficient steel backing to effect the addition of serrations to the back of the blade. The heavy carbide tip remains the dominant material and tends to eliminate the tendency of bimetal cracking of carbide under thermal strains.



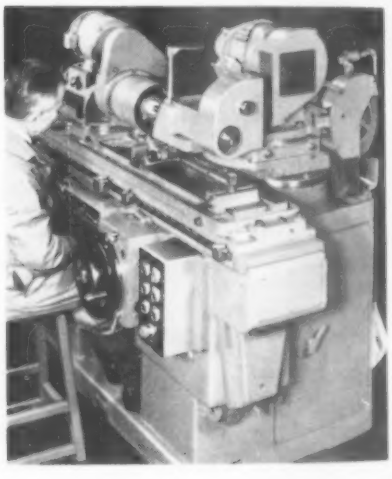
Positive locking of the blade in the cutter is effected by a hardened tool steel serrated wedge, lipped on its outter portion to provide a positive resistance to feed thrust on the blade, independent of the locking screw.

The tool steel wedge, behind the blade, allows for a higher hardness to the blade seat than obtainable when seated directly against the cutter body and further eliminates cutter body damage in the event an accident breaks a blade. If the wedge is damaged it can be replaced by stocked replacements.

The Viking Tool Company will supply these face mills with the number of blades, and radial and axial rakes to suit the job. Double negative, zero, and double positive rake cutters will be cataloged. Other combinations of rake angles, and number of blades cutter will be manufactured to order. T-10-32

Universal Hydraulic Grinder

The Rivett No. 1024 Universal Hydraulic Grinder is designed to perform all the internal and external grinding encountered in the average toolroom, and combines, in one machine, features found separately in an internal grinder and in a plain external grinder. General work range includes hole grinding from 1/8 to approximately 9 in. diameter up to 8 in. depth, and external grinding to 12 in. diameter up to 18 in. length. Straight, taper, 2-angle, face and shoulder surfaces can be ground, and work may be held in collet, step or jaw chuck, on face plate or between centers.

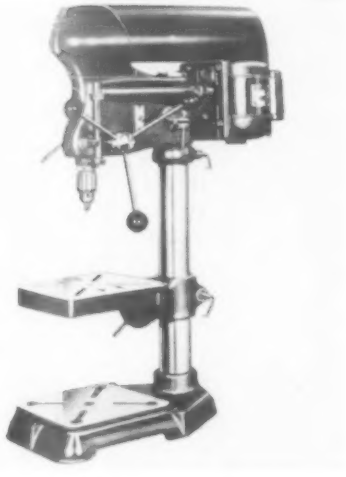


In addition to other features that reduce set-up time, a double-end wheelhead quickly swivels 180 deg to position either the external or internal wheel for grinding.

All grinding spindles are cartridge type, flange-mounted, with anti-friction bearings grease-sealed for life, and the workhead spindle has infinite speed adjustment. Collets and step chucks mount directly in the spindle for accurate and quick mounting for work, while a standard 5 in. sine bar measures the swivel of workhead or table for precision taper grinding. Micrometer table stop, fine feed for compensating wheel wear and hydraulic table control are among the many features which add to the machine's efficiency. Complete information is contained in Bulletin 1024A, available on request from Rivett Lathe & Grinder, Inc., 22 Riverview Rd., (Brighton) Boston, Mass. T-10-33

15-Inch Drill Press

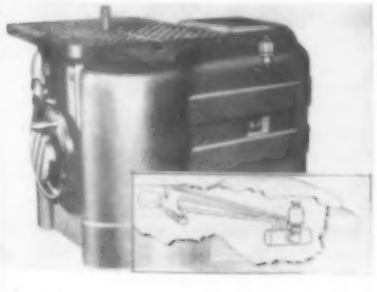
Famco Machine Company, Racine, Wis., announces a 15 inch Drill Press in a series consisting of 7 models—bench and floor types, in tilting table or one, two, three and four-spindle production models. Chuck capacity ranges from No. 70 to ½ in. Jacobs Chuck with No. 1 Morse Taper optional.



Of rugged construction, this Famco-designed press is precision machined throughout and is said to offer the largest quill in its price field—2-3/64 in. Extra-long (4½ in.) stroke, with a shorter, six spline spindle, provides greater bearing support and rigidity, and gives improved accuracy.

Spindle speeds range from 625 to 4800 rpm in Standard models, and from 490 to 3000 rpm, on Slo-Speed models, to as low as 185 rpm with a speed-reducing attachment. The latter attachment, together with belt guard and tapping attachment, is optional equipment on all Famco models. **T-10-34**

Oiler for Profile Grinder



An Oiling System, for Boyar Schultz No. 1 Profile Grinder, consists of a reservoir with three distributing lines—one to the spindle and one each to the two ways on which the oscillating mechanism operates. The system is said to keep the spindle thoroughly lubricated, thereby increasing its life of grinding accuracy. By Boyar-Schultz Corp., 2110 Walnut St., Chicago 12, Ill. **T-10-35**

Vise for Small Parts

A holding tool designed for rigidity and versatile positioning—the Micro-Vise, by Metal Items, 820 Sixth St., Racine, Wis.—consists of two units, a vise and a fixture.

The vise proper, which incorporates two vises in hardened and ground jaws, will hold work on either side and may be swiveled from horizontal to vertical in any intermediate angular fractions. Demounted, the vise may further be used as a holder for work on machine tables or on a magnetic chuck, or, it may in turn be held in a larger vise. **T-10-36**

Universal "Col-Vise"

Because a single turn of the handle frees the jaws for push-pull opening or closing, the "Col-Vise", by Universal Vise & Tool Co., Parma, Mich., saves valuable time on typical drill press operations and, in addition, often saves the time and cost of making simple jigs and fixtures.

The vise clamps to the column of single or multiple spindle drill presses. Position of the vise is adjustable both angularly and radially, and the entire device can be swung clear when necessary. The vise itself has 1½ x 4 in. jaws and a maximum opening of 6 in.

Models to fit drill presses with either stationary or movable tables are available. Column diameters of $1\frac{7}{16}$ in. through $3\frac{29}{32}$ in. can be accommodated. By removing the column connection, the vise can also be used as a quick-acting machine vise, with three ears for bolting to the machine table. **T-10-37**

Contour Sawing Machine

An all-purpose combination Contour Saw and Band Filer is announced by Boice-Crane Co., 934 Central Ave., Toledo 6, Ohio. As compared to milling, shaping and hand filing methods of finishing, this modern-method machine is said to effect remarkable time savings in cutting, filing and file broaching of small run production parts, maintenance parts; irregular shaped stacked parts; spiral parts, tools, templates and stamping, forming and trimming dies.

Designed for high-speed operation, the machine has a speed range up to 4100 fpm for cutting wood and other industrial materials, and ranging down to 92 blade fpm for cutting tool steel, ferrous and non-ferrous metals, and for fast filing of a variety of materials. Inside contouring is facilitated by an automatic electric blade-butt welder, which is included. File bands, available in two widths, two shapes and six cuts, suit most purposes for which the machine is designed. Fully described in a brochure, available on request.

T-10-38

Tube Fitting Chart

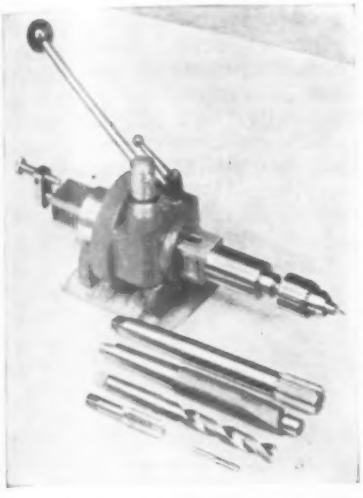
An 8½ x 11 in. Display Card conveniently listing nomenclature for fourteen tube fitting shapes and five fitting parts is available from The Parker Appliance Co., Cleveland 12, Ohio.

Shapes are illustrated and described with code designations for each in four types—Triple-lok 37 deg flared, Triple and Triple XX 30 deg flared and Feru lok flareless—in steel, stainless, brass and dural. Corresponding AN part numbers are also listed, and a chart relating tube size numbers with tube OD's and pipe thread sizes is included.

T-10-39

Turret Attachment

A sensitive turret attachment—the Star—designed to give the operator a more delicate "feel" of work being done on a turret lathe, is now available from the Williams and Hussey Machine Co., Inc., Wilton, N. H. It is claimed that, with the help of this attachment, tapping from 6/32 in. up and operations such as centering, drilling, reaming and counterboring can be done with greater ease and less tool breakage.



In use, the attachment is mounted in any one of the turret positions and the handwheel is used to bring the turret up near the work. Then, using the lever arm to control in-and-out motion, the lathe operator has sensitive finger-tip control of the operation to be done. The attachment is available in five sizes and all mount directly on turrets with or without adapters, depending on the make and model of the lathes being used. **T-10-40**

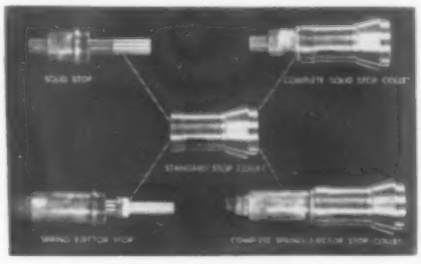
Pulley Grooving Blanks

A standardized line of solid cemented Carbide Blanks, composed of six sizes and specifically designed for pully grooving tools, has been announced by Carboloy Company, Inc., of Detroit, Michigan.

Designed for the tools used in machining pulleys for A, B, and C type V-belts—both 34 deg and 38 deg—these carbide blanks are all available from stock. Blank thickness for all sizes is standard at 5/16 in.; length ranges from 1 to 1½ in. Tips for pulleys using belts less than 1 in. nominal width are standard in Carboloy Grade 883; larger sizes in Grade 44A. However, the blanks can be supplied in other grades of Carboloy upon request, subject to quotation. **T-10-41**

Standardized Stop Collets

As a result of the popularity of their universal collet stops for their high speed precision second operation machines, Hardinge Brothers, Elmira, N. Y., now announce manufacture of Standardized Stop Collets and Stops for Brown & Sharpe machines. These standardized accessories obviate both the need of designing special collets or stops and the cost incidental to such improvisation.



With the Hardinge standardized stop collets and stops for Brown & Sharpe machines, the operator or setup man can apply either a solid stop or a spring ejector stop to a standard stop collet. The latter are threaded for direct application of either type of stop. These accessories are fully described in Hardinge Bulletin "SC", available on request. **T-10-42**

North East West South IN INDUSTRY

Delegates from 18 countries met in Paris for a recent meeting of the **International Standardization Organization** in an effort toward unification of various national standards on screw threads. Fifteen members voted to recommend the Unified Anglo-American screw thread to their national standardizing bodies as the common profile for the metric and inch systems of screw threads.

An iron-silicon-magnesium alloy has been developed by chemists at the **Naval Research Laboratory** which, when added to gray iron, can produce nodular graphite variety of iron of unusually high strength, shock resistance and ductility. Also it does not require simultaneous use of large amounts of nickel or copper. Preliminary tests indicate possible elimination of the final inoculation treatment, formerly required, resulting in but a single instead of double ladle treatment. Use may result in higher recoveries of magnesium and decreased danger of violent reaction during solution of the alloy in molten iron.

Schaublin Ltd., Bevilard, Switzerland, makers of lathes, milling and drilling machines, and **Tornos Works, Ltd.**, Moutlier, Switzerland, makers of screw and cam shaping machines, both have announced appointment of **Hauser Machine Tool Corp.**, Manhasset, N. Y., as their exclusive U. S. factory representatives.

Sale of Borg-Warner's **Superior Sheet Steel Div.** Plant, near Canton, O., to **The Louis Berkman Co.**, of Steubenville, O., was announced by Roy C. Ingersoll, president of the division. Mr. Louis Berkman, president of the purchasing company, stated that future plans for the mill are indefinite.

Included in a number of recently announced personnel appointments at **Westinghouse** were **Bernard F. Langer**, who became manager of structural and heat engineering, and **Erling Frisch**, who was made manager of control engineering.

W. C. Rowland was named manager of the company's manufacturing and repair division in view of illness and approaching retirement of vice-president H. F. Boe, who had headed the division; **G. L. MacLane, Jr.**, was announced manager of the engineering laboratories, succeeding Thomas L. Spooner who retired after 40 years with Westinghouse; and **Hendley Blackmon**, formerly managing editor of "Product Engineering" and later of "Electrical World," was named assistant manager of engineering association activities.

Walter M. Reynolds has been elected secretary of **Morse Chain Co.**, division of **Borg-Warner Corp.** Mr. Reynolds also is controller of the division. The duties of treasurer have been assumed by **R. P. Johnson**, first vice-president of the company. The newly filled posts formerly were combined in one office.

A new engineering company, **Mechanical Industries, Inc.**, interested in industrial ventilation, smoke, dust and fume control, has been formed in Pittsburgh it was announced by **Morton I. Dorfan**, the company's president and general manager. Prior to the firm's establishment, Mr. Dorfan was connected with the American Wheelabrator & Equipment Corp.

The **Independent Research Committee on Cutting Fluids** (IRC) plans to expand in membership and to resume

Coming Meetings

October 17-21, **American Society for Metals**; annual meeting. Cleveland. (**National Metal Congress**, concurrently, Cleveland Public Auditorium.)

October 17-21, **American Welding Society**; annual meeting. Cleveland.

October 17-21, **American Institute of Mining and Metallurgical Engineers**; fall meeting. Cleveland.

October 17-21, **Society for Non-Destructive Testing**; annual meeting. Cleveland.

October 27-28, **Gray Iron Founders' Society, Inc.**; annual meeting. Edgewater Beach Hotel, Chicago.

October 27-29, **American Society of Tool Engineers**; Seventeenth Annual Meeting. Mount Royal Hotel, Montreal, Quebec. (H. M. Windsor, ASTE, 10700 Puritan Ave., Detroit 21, for reservations.)

November 2-4, **Industrial Management Society**; Annual Time and Motion Study Clinic. Sheraton Hotel, Chicago

work in the field of industrial utilization of cutting fluids, including survey and publishing data on current practices. The announcement was made by Joseph Geschelin, the committee's general chairman.

The **L. S. Starrett Co.**, Athol, Mass., has announced the purchase of the **Burrill Saw and Tool Works**, Ilion, N. Y., manufacturers of Paramount band knives and saws. These lines now will be manufactured in Athol in a new building which increases the Starrett manufacturing facilities to nine acres of floor space.

Announcement is made of the appointment of **Isham Keith** to succeed Harold F. Welch as machinery manager of the New York branch office of **Pratt & Whitney**, division of **Niles-Bement-Pond Co.** Mr. Keith has been with this organization 20 years.

Isham Keith

John F. Miller

Harold B. Smith, president of **Illinois Tool Works**, Chicago, has announced the appointment of **John F. Miller** as manager of the company's tool division. Mr. Miller was formerly sales manager of the machine tool and cutting tool divisions of Ex-Cell-O Corp., Detroit.

Benjamin S. Sampson, formerly district sales manager for Stewart Furnace Div., Sunbeam Corp., has been named manager of the Industrial Furnace & Oven Div., **Claud S. Gordon Co.**, 3000 S. Wallace St., Chicago 16, Ill.

Four divisional managers recently appointed to supervise sales of electrical wire and cable for **United States Rubber Co.** include **Clarence H. LeVee**, eastern; **J. A. Leuver**, western; **Don B. Karlskind**, southwestern, and **J. M. Guibara**, Pacific coast sales.

George A. Pockels has been named director of European operations, with headquarters in Paris, by **Clearing Machine Corp.**, Chicago, in order to serve European owners and prospective buyers.

Mid-States Welder Manufacturing Co. has been formed to take over manufacture of lines of welding equipment formerly produced by Mid-State Equipment Corp. Production equipment and general offices have been moved to 6025 S. Ashland Ave., Chicago. **Frank V. Lockefer**, long associated with Mid-States, is president of the company, and **Henry Cleys**, president of Electrical Contractors, Inc., is its secretary-treasurer.

THE TOOL ENGINEER'S *Service Bureau*

Air & Hydraulic Devices

"The Facts of Life on Air and Hydraulic Devices" deals with maintenance of air and hydraulic valves, air, hydraulic and airdraulic cylinders; hydraulic power units; lines and power chucks, plus condensed "Do's" and "Don'ts" for setting up and servicing equipment. *Logansport Machine Co., Inc.*, Logansport, Ind.

Bearings

Four-page catalog 449 presents live center bearings both standard and special types "engineered" for specific metal working operations; also specification and price lists for adapter, tubing and straight shank centers. *Sturdimatic Tool Co.*, 5220 Third Ave., Detroit 2.

Chucks, Automatic

Recently developed heavy-duty power chuck, "Air-O-Torque", discussed as to construction, performance, operation and adaptability; illustrated by diagramatic drawings. *Whiton Machine Co.*, New London, Conn.

Cylinders, Air

Eight-page booklet shows detailed dimensional and cross section drawings of B-R air cylinders including various types of mountings; plus specification tables for each cylinder type. *Richter-Shillair Co.*, 1317 S. Park St., Saginaw, Mich.

Diamond Compound

Folder describes Dymo, crushed, graded and compounded diamond to form an abrasive compound; table gives general recommendations, grade, micron size range, mesh size equivalent and diamond content for each compound number with color and price. *Elgin National Watch Co.*, Industrial Products Div., Aurora, Ill.

Diamond Wheels

Line of resinoid bonded diamond wheels described as to types, sizes, and advantages in 36-page catalog by Diamond Wheel Dept., *Manhattan Rubber Div., Raybestos-Manhattan, Inc.*, Passaic, N. J.

Die Polishing

Machine for polishing dies by use of an endless abrasive belt driven at grinding wheel speed is pictured and described in leaflet by *Whiton Special Machinery Co.*, Hartford, Conn. Includes specification and data tables.

Die Sets

Comprehensive 104-page catalog No. 5 covers die sets and accessories, generally classified with color index for time-saving reference. Illustration and specification tables for each item. *Die Supply Co.*, 5348 St. Clair Ave., Cleveland 14.

Gages

Swedish Gage Co. of America presents illustrated catalog outlining important features of its precision micrometers in addition to size, range and price tables. 8900 Alpine, Detroit 4.

Grinding Wheels

Non-technical booklet, "Safe Speeds for Grinding Wheels" discusses rules governing safe operating speeds and their importance in relation to productivity. *Grinding Wheel Institute*, P.O. Box 64, Greendale, Mass.

Grinding Wheels

Folder introduces and describes advantages of self-dressing, centerless grinding wheel made with tempered abrasive to grind tempered steel. *Midwest Abrasive Co.*, Owosso, Mich.

Lathes

Eight-page brochure pictures various size lathes; gives complete description of lathe parts and table of detailed specifications. *The Springfield Machine Tool Co.*, Springfield, Ohio.

Machine Cleaner

Bulletin to instruct in the use of Lusol machine cleaner, published by *F. E. Anderson Oil Co.*, Portland, Conn., relates the "why" of machine cleaning and outlines benefit of clean machines and effectiveness of Lusol as a periodic cleaner.

Motors, Air

Types of Bellows non-rotating air motors shown in Bulletin BM20-R featuring discussion of controlled-air power and specification drawings. William C. Richards, Jr., *The Bellows Co.*, 222 W. Market St., Akron, Ohio.

Notching Equipment

Bulletin F illustrates Wales louver notching units for notching slits in flat sheets. *Wales-Strippit Corp.*, 345 Payne Ave., North Tonawanda, N. Y.

BOOKLETS, CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Presses

Verson Allsteel Press Company bulletin describes facilities for rebuilding pressess showing typical assemblies of presses rebuilt by them. Suggests possibilities to manufacturers interested in modernization. 9336 S. Kenwood Ave., Chicago 19.

Reamers, Taper Bridge

Supplement to Catalog 16 shows taper shanks of high speed steel for use in pneumatic tools for boiler, bridge, ship and structural iron work; accompanying tables of specifications. *National Twist Drill & Tool Co.*, Rochester, Mich.

Recessing Tools

Photos, cut-away and cross-section drawings illustrate manual dealing with applications, operations, construction and advantages of automatic recessing tools; specification and stroke charts included. *Scully-Jones & Co.*, 1901 S. Rockwell St., Chicago 8.

Sharpeners, Broach

Special features and operating details of broach sharpener for round and flat broaches outlined in Bulletin No. CS4-36. Specification table, operating data and lists of standard and special equipment included. *Colonial Broach Co.*, Box 37, Harpur Station, Detroit 13.

Shop Press, Hydraulic

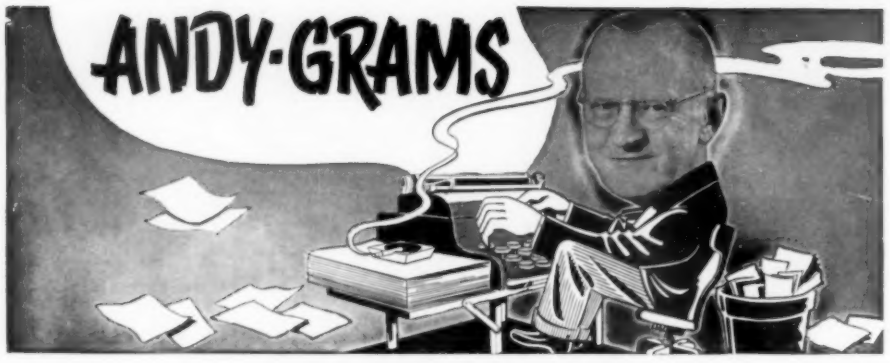
Catalog 313 illustrates line of standard and special shop presses from 60 to 400 tons, plus hand and power pumps and press accessories; includes study of construction and operations features and specifications. *Rodgers Hydraulic, Inc.*, St. Louis Park, Minneapolis, Minn.

Valves, Solenoid

Valvair announces line of solenoid-operated valves and double solenoid valves for air pressures of 0 to 125 psi in 4-page folder-S; includes price lists. *Valvair Corp.*, Akron, Ohio.

Wire, Welding

Application instructions, surface preparation, spraying and fusing, cooling and finishing; also proper settings on standard wire metallizing guns set forth in booklet on Colmonoy sprawled wire by *Wall Colmonoy Corp.*, 19345 John R St., Detroit 3, Mich.



In the September Column, I mentioned some personal repairs, most of which have now been taken care of. And wait 'til you see me! I've gained so much weight that bye'n'bye Slim McClellan will be eclipsed by my shadow, and as for looks I'll even have something on Rudy Valentino a/c he is dead and I'm here.

Just as I thought I was all set, however, lightning struck. My sacroiliac went out of whack, pinching the sciatic nerve, and if that ain't hellonwheels I'd like to know! So, I betook me to an osteopath who, starting in where Swedish massage leaves off, whacked, thumped, twisted, stretched and pulled until, at the end of a course of sprouts, I felt as if I had pneumatic cushions between my joints, being that springy. But, by golly, he fixed me up! By the way, how is your sacroiliac?

Well, summer's over and we now swing into fall activities, including the Semi-Annual in Montreal. Better get in on that, Montreal being a really nice town besides which the Canadians are swell fellows and I don't want you boys N.E.W.S. to let 'em down. So, get on the band wagon and show 'em a Yankee invasion of the sort they'd like. From my end, greetings and good luck.

Detroit tool engineers are going to miss likeable Chite Lee, late head of the Lee Engineering Company. Chinese, and a prime favorite with the local boys although, surprisingly, not a member of the ASTE, Lee recently joined his ancestors as a result of an automobile accident. In a brief newspaper account, I also read where, somewhere up in the Sierras, they'd found the bones of Frank McKenna, formerly prex of Knu-Vise Company, Detroit, along with his pilot and the wreckage of his plane. Frank simply vanished from human ken when, back in '41, he left L.A. for destination unknown. Trouble with him he was too fast with the accelerator and too slow to apply the brakes. I should know, having been a passenger with him on several occasions.

Any of you boys N.E.W.S. interested in antique guns? I'm disposing of my collection, all but a flintlock and a "pepperbox" respectively presented by John Sundkvist and Roy Bramson. Just haven't time to ride that hobby.

(Free) Adv.—I hope.

From one thing to another, I've been called many things in my time—radical and reactionary, fascist and pink included—all depending on what side of the fence the namers happened to be standing. Actually, I'm just a middle-of-the-roader between extremes. However, I happened to be one of a group that, meeting at lunch over a period of years, would spice the repast with spirited debate over some hot issue of the day.

The hottest debate of all centered on the inch-metric controversy, and the payoff on that was when an arch exponent of the inch system put the case for metric so strongly that he all but converted his fellow sticklers-for-inch. The point is that an outsider listening in on those debates would have been fully justified in labelling individual members of the group according to their expressed views of the moment.

In a way, those discussions were educational and conducive to harmony rather than to discord. Often arguing against our own convictions, we became less opinionated and more objective in our views. And that bears out my contention that the only way one can intelligently evaluate anything is to know all about it, its cons as well as pros. Take communism, for instance, so befogged by pro-and-con propaganda that the man on the street is beginning to wonder what lies behind the smoke screen, let alone the "iron curtain."

What, after all, is communism? Tersely defined, it implies collective ownership which, if operated as a free enterprise, could actually be a boon to society. Take the poor in the slums, for example. By buying a pat of butter, a few potatoes and an egg or two, and so on, they actually pay more per unit of weight or measure than their richer fellows who buy in quantity. But, if all of the families in a block were to pool their purchases, then they could demand near wholesale prices. That would be communism on a small scale—or, if you prefer, a cooperative enterprise from which the entire community would benefit.

That, of course, is the potentially benign phase of communism. Unfortunately, it hasn't worked out that way; rather, it has become a tool for exploitation by dictators who are even more tyrannical than the comparatively mild despots whom they superseded. Therefore, its encroachment has been resisted by all freedom loving people, and it is significant that it has taken but precarious root in advanced societies where the people have had free access to full information regarding its pros and cons, the day.

For that reason, I personally deplore thinking which would outlaw communism and thereby drive it underground. No force so insidious as that which works under cover. No, keep it in the open, the way they do with the zanies in Pershing Square, Los Angeles, who get nowhere with their rantings. And what rational thinker would subscribe to communism once it were objectively compared to democracy as we know it here in America?

America is a land of opportunity. No other land promises the worker so much, nor on the whole so faithfully keeps promises. Here, the average wage earner owns a good home replete with modern conveniences, drives a car and enjoys luxuries that, in the aggregate, are privileged only to the comparatively wealthy in even the most advanced of European lands. No need for us to promise a Utopia; we've been building one for over 170 years.

From the foregoing, it may be assumed that I am anything but pink. Still, there are times when one gives token agreement to another's views, however screwy. F'rinstance, I had to attend a banquet in Chicago not too long ago and, changing to soup-and-fish in the depot washroom, went into the barber shop for a shave and a hair-do. . . . well, yes, a hair-do.

To judge by his talk, the barber was a rabid red, and I listened in discreet silence as he extolled the coming (?) Utopia, the razor all the while caressing my cheeks and suggestively lingering around the jugular. One just doesn't argue in a situation like that. However, I didn't tip, for the nonce putting myself among the proletariat.

Well, so much for that. Personally, I think there's been too much pother about communism and too little about democracy. Let's try selling that for a change, but not by mob violence which is only grist for the mills of the Reds. Only a clean pot has any business calling the kettle black.

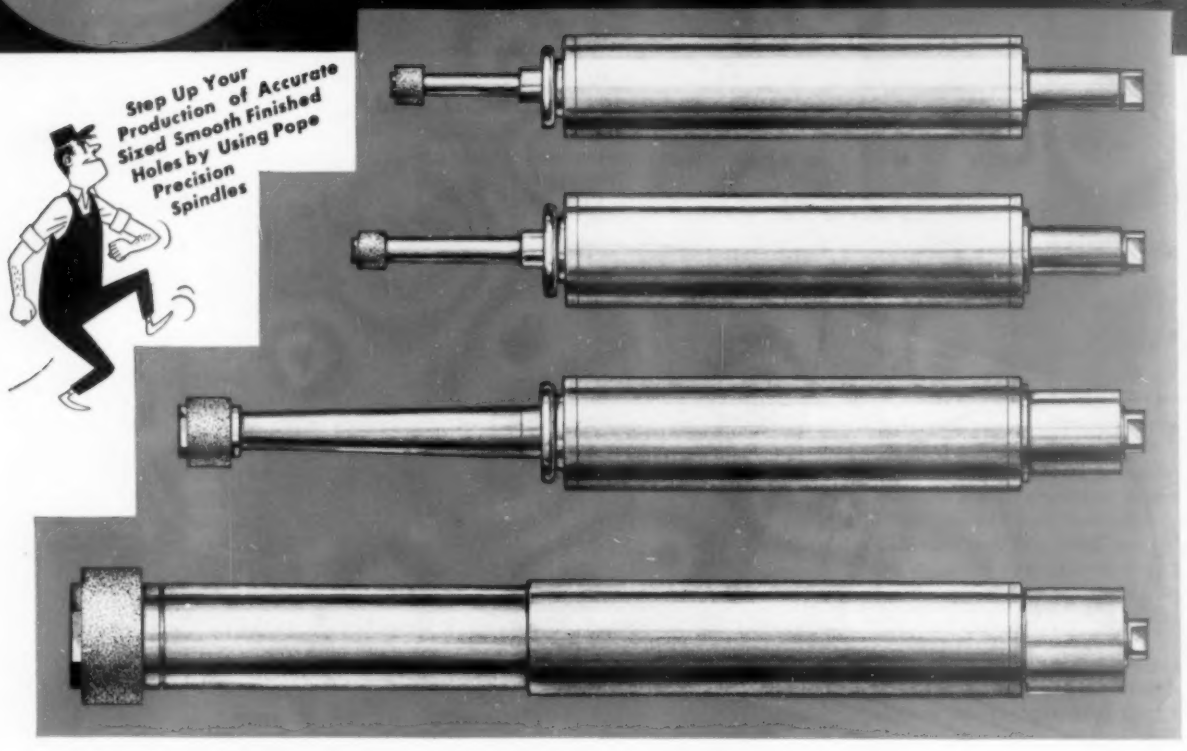
Right now, I've other worries, especially how to satisfy everybody who's clamoring for reprints of the Lengbridge articles on Aluminum Presswork. Like many other articles which have appeared in The Tool Engineer, notably the Symposium on Gears and Jim Walker's articles on Presswork, this series—a collaboration between John Lengbridge and Aluminum Laboratories Ltd.—has created such demand that, temporarily at least, we'll have to limit the number of reprints per applicant. So, please be patient; we're doing the best we can to satisfy everybody. And now, 'til if and when we meet again I am

ASTEely yours

Andy

7 sound reasons why

POPE PRECISION INTERNAL GRINDING SPINDLES WITH THE POPE SEALED-IN LUBRICATION SYSTEM ARE THE RIGHT SPINDLES FOR YOUR GRINDERS



1. **Increased Production.** Pope Spindles speed up output because they can take heavy cuts.
2. **Better Finished Ground Holes.** The precision craftsmanship used in the manufacture of Pope Spindles assures work of the highest standard.
3. **Increased Wheel Life** because the shaft is rigidly supported by bearings of ample size, properly preloaded to withstand both radial and axial loads.
4. **Super Precision Bearings** made to Pope specifications are used exclusively in Pope Spindles. These bearings are all international standard sizes.
5. **Operating Time Saved** by eliminating frequent change of motor pulleys. Pope Internal Grinding Spindles are designed to be driven from the same motor pulley except in rare and special applications.
6. **No Lubrication** is required during the life of the bearings. Time is saved and production is increased by not having to add oil or grease to the bearings periodically. The lubrication is sealed in during bearing assembly by skilled craftsmen in a clean, dust free, air conditioned room, properly tooled up for the job. There are no more time-consuming breakdowns caused by dirt or abrasive entering the bearings through the oiling system. With the Pope Sealed-In Lubrication System, all foreign matter is sealed out at the same time lubrication is sealed in.
7. **Dynamic Balance.** Pope Spindles are dynamically balanced with all their rotating parts in full assembly.

These seven features add up to better work and more of it per day at lower cost. In other words you make more money when you standardize on Pope Spindles.

Pope Precision Internal Grinding Spindles come in the sizes, shaft extensions and speeds (up to 35,000 RPM) to meet your every need. Ask for new catalog No. 57.

No. 63

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

BUILDERS OF PRECISION SPINDLES

Illustrating some of the many parts which have been profitably broached. Included below are wrenches, pliers, wheels, spindles, gear blanks, clutch hubs, and many others.

Cut Production Costs by Broaching the *American* Way

The parts shown are excellent examples of the wide variety of irregular shaped parts that can be broached. In this photo there are serrations, slots, notches, radii, and flat surfaces which have been surface broached. There are involute splines, rectangular holes, helical splines, serrations, and round holes which have been internally broached. If you produce parts requiring similar machining, you should . . .

INVESTIGATE BROACHING

There are several ways in which broaching can lower costs and improve production. On multiple station units a part can be broached at each station at the same time, greatly increasing the production, or each station can broach a different surface thus completing two or more operations on a single part. Completely automatic continuous broaching cycle, with the operator only loading the magazines, can also be provided when the part permits, for exceptionally high production requirements.

INVESTIGATE *American*

American engineers will work with you to simplify your metal cutting problems. Consult American and get the advantages of a complete broaching service. American builds every type of broaching machine and provides a size and capacity to handle every broaching need. They will design and build your broaches and the work fixture to give you the maximum benefits of broaching. Write to American. If you can, send a part print or sample part, and hourly requirements. Write Dept. T.

AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

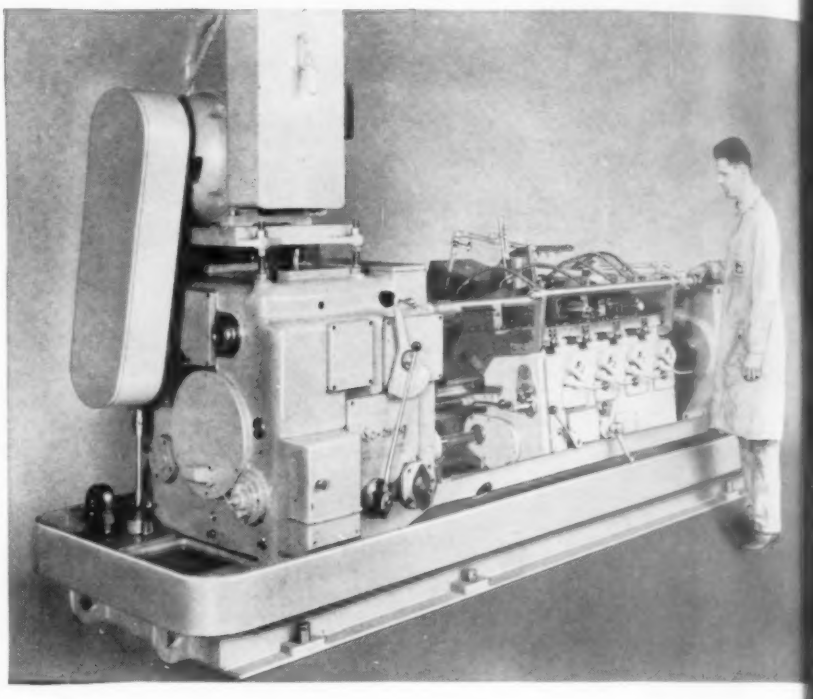
ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YO

MODEL "AP" Lo-swing LATHE MACHINES ELECTRIC MOTOR SHAFTS



Problem: To rough turn, face shoulders and groove electric motor shafts machined in small and medium size quantities.

Solution: This new Lo-swing Semi-Automatic Lathe, featuring *unlimited length of carriage travel thru rack and balanced twin pinion carriage feed*, is ideal for machining short and medium run jobs economically. Unlimited carriage travel permits turning of short run jobs having long shoulder lengths with simplified tooling; multiple tooling may be used for long run jobs with short or long shoulder lengths.

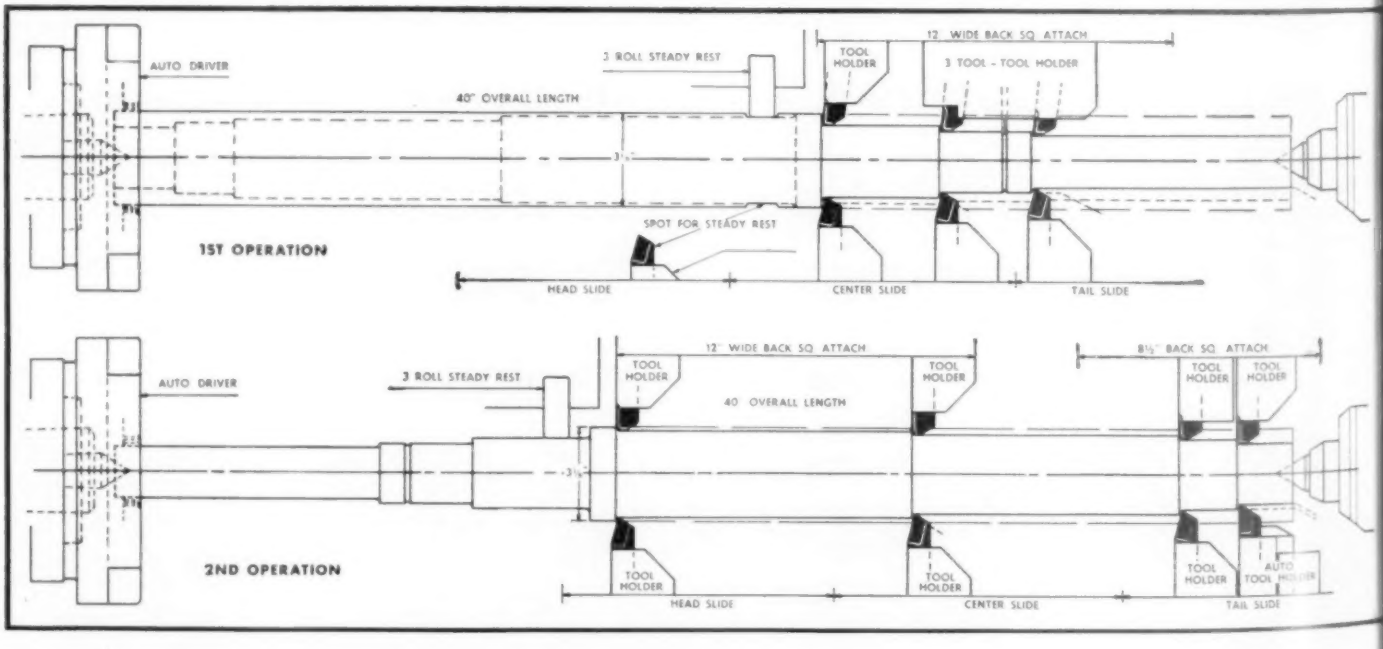
The drawings below show a typical two operation tool setup on electric motor shafts which are being machined in small lots. Only the one tool is being used for turning each diameter regardless of the length of cut.

Machine setup is simplicity itself. First, the tool blocks and tools are mounted on the tool slides in the proper relation to each other and for the proper depth of cut. Secondly, two stops are set for controlling length of carriage travel in both directions and one stop for positioning the carriage in relation to the work piece. The lathe is then ready for productio

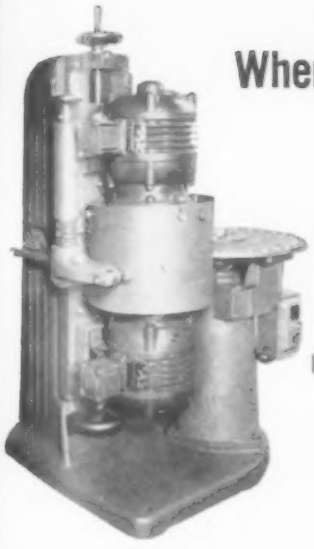
Tool relief is automatic on the return stroke of t carriage and rapid traverse movements to and fro the work are available by throwing a lever.

Investigate the many unique features of this ne semi-automatic lathe.

SENECA FALLS MACHINE CO., SENECA FALLS, N.



PRODUCTION COSTS ARE LOWER WITH Lo-swing



No. 902 Besly Vertical Spindle Grinder for small coil springs, carbon brushes, ceramic parts, etc. Handles up to 4000 pieces per hour — $\frac{1}{8}$" to 1" O.D. and from $\frac{1}{4}$" to 4" long.

When It's a Matter of Grinding Springs and Small Parts...

Only BESLY

Offers This *Complete* Line of Production Grinders

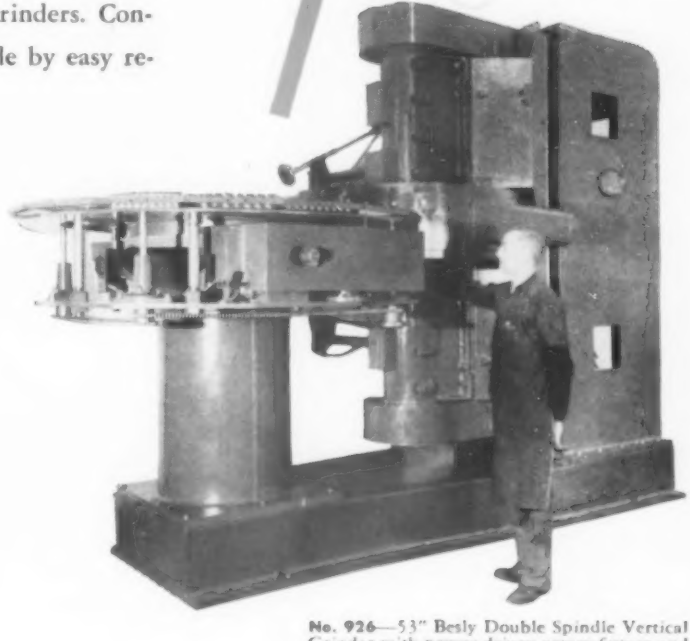
14 BASIC MODELS *Proved in Use*

Whatever the job specifications may be, there's sure to be a Besly Grinder that will do the work faster on closer tolerances —*with greater economy*. Sizes range from those that handle the smallest parts to large capacity units for grinding railroad car springs and similar large pieces. Fourteen different types are available to select from. Besly engineering adapts basic models to specific requirements of the user. Versatility in doing many grinding jobs well is characteristic of Besly Grinders. Conversion from one job to another is quickly made by easy replacement of the work holder.

Simplify production! Cut job costs! Talk over your requirements with a Besly engineer. Besly Grinders earn their way with savings of time, labor and material.

TITAN WHEELS

Write today for this helpful booklet which offers useful facts on abrasive wheels . . . It's free. Contains much valuable data on grinding wheels and abrasives. Learn how Besly-Titan Steelbacs cut "down time" and boost output.



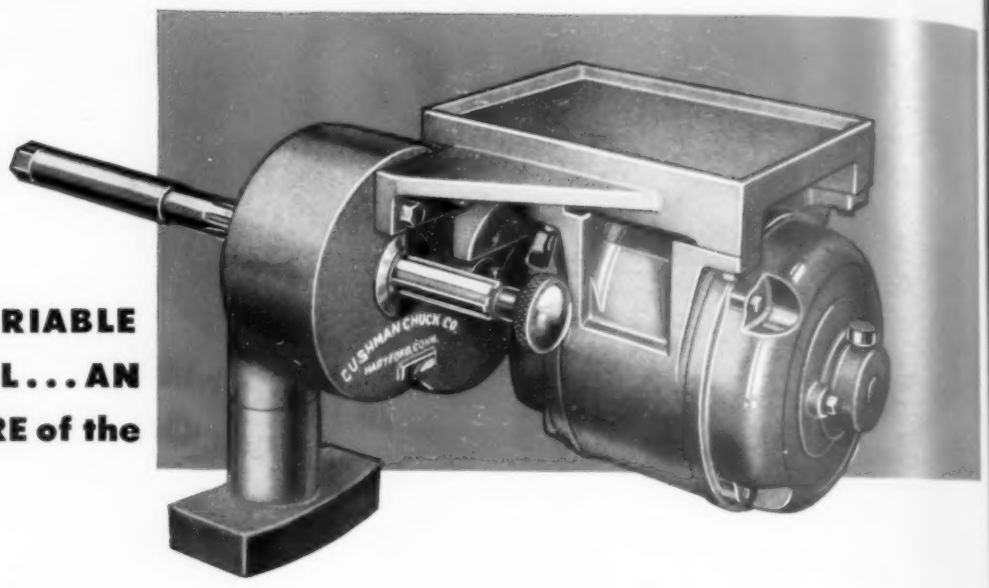
No. 926—53" Besly Double Spindle Vertical Grinder with power driven rotary fixture and multiple station feed wheel. Tooled for coil springs $\frac{3}{4}$" to 6" long—800 to 1500 per hour.

Maybe GRINDING is the Better Way . . . Better Check with

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

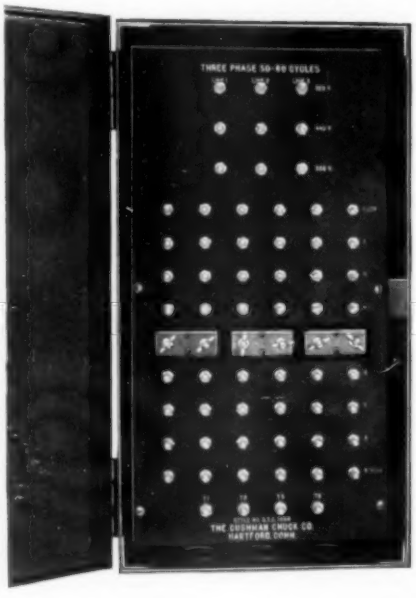
BESLY

CHARLES H. BESLY & COMPANY • 118-124 North Clinton Street, Chicago 6, Illinois
***Factory:* Beloit, Wisconsin**



"Cushmatic" VARIABLE TORQUE CONTROL... AN EXCLUSIVE FEATURE of the

CUSHMAN *Power* WRENCH



"Cushmatic" torque control box, connected to power line thru lever drum switch (or push button and line starter). Torque and inertia easily adjustable... 9 stages down to 25% of maximum... 220, 440, 550 V.

SEND FOR BULLETIN NO. 211D

The Cushman Power Wrench with its "Cushmatic" variable torque control box gives the operator a simple and highly accurate method for setting and maintaining a predetermined torque value in 9 stages from 150 to 600 ft. lbs.

Thus the wrench action is positive, safe and fast... opening and closing jaws automatically... reducing employee fatigue, speeding repetitive production with heavy chucks.

We offer as optional equipment control by means of drum switch or a heavy duty push button and reversing line starter. The machinist will need but little instruction to become thoroughly efficient in the automatically safeguarded operation of the Cushman Power Wrench.

THE CUSHMAN CHUCK COMPANY
Hartford 2, Connecticut

Consult CUSHMAN

Chucking Engineers Since 1862

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Norton "Know-How"
Can Cut Your Grinding Costs

1. **Research "Know-How"**—A staff of over 135 trained scientists and technicians constantly developing new abrasives and new bonds for lower grinding costs.

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ABRASIVES®

AVAILABLE FROM NORTON . . .

Real Abrasive "Know-How" *plus* the *Most Complete Abrasive Service* in the World

Abrasives for Tumbling and Polishing

Grinding Wheels

Segments

Wide Variety

Abrasives for polishing, tumbling and lapping, grinding wheels, segments, discs, bricks and sticks, coated abrasives* and sharpening stones* to meet *all* demands of industry.

Widespread Distribution

Grinding wheel distributor stocks in over 300 cities throughout the world, warehouse stocks in five industrial centers of the United States, factory stocks at the main Worcester plant and at six foreign plants.

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A Norton field staff of abrasive engineers and Norton factory specialists cooperating with over 2500 distributor representatives the world over.

*Products of Behr-Manning Division

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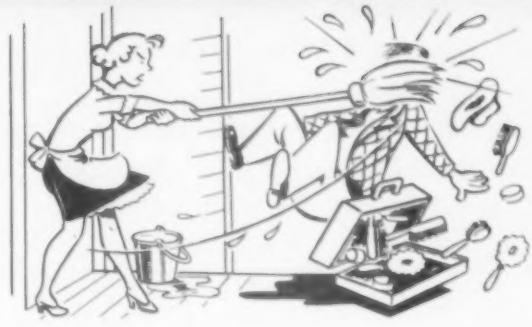
Behr-Manning, Troy, N. Y., is a division of Norton Company

Salesman Brutus, when he "taps" on the door,
Shakes the foundations as he knocks with a roar.

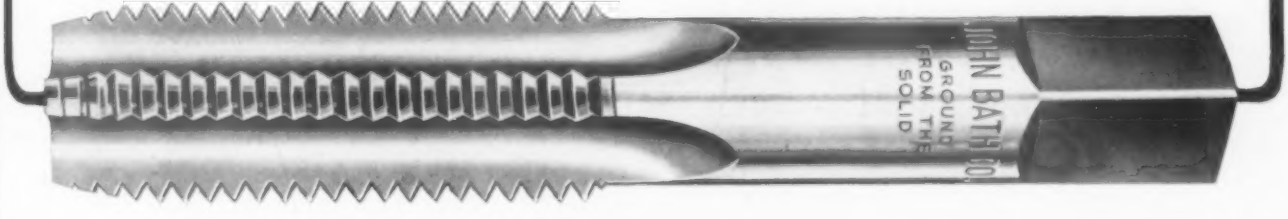


Brute force has no place in our way of life.
In house to house selling, it irks the housewife.

JOHN BATH CO. INC. · WORCESTER · MASS ·

When starting a tap, keep FORCE in control
Or you'll ruin your work with a bell-mouth hole.

For work that's admired, all men are agreed
Bath taps need no force—they'll find their own lead!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

Bath ground thread taps are made from the highest quality steel. Ground from the solid after hardening, these modern cutting tools are of uniform structure and consistent accuracy.

The uniform hardness of the cutting edge of Bath taps increases tap life and lengthens tap service between grinds.

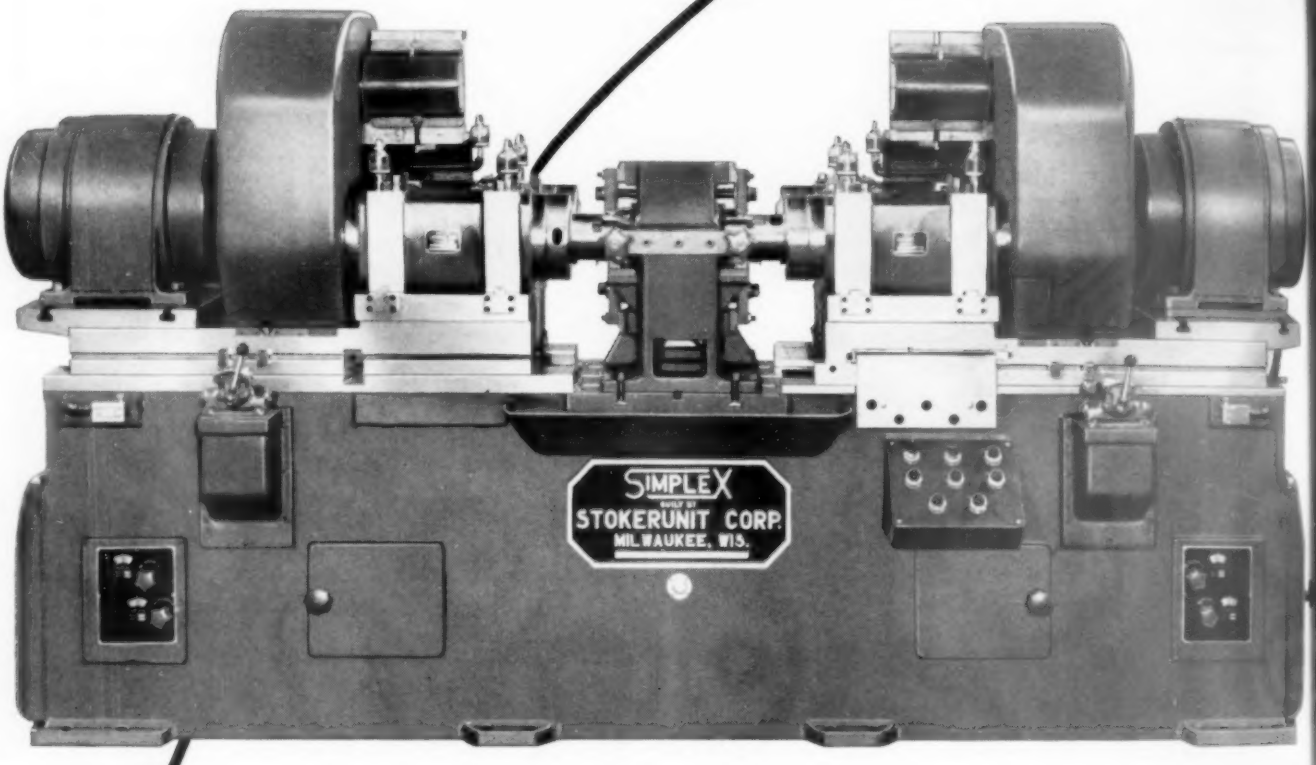
Bath taps are made in many styles for threading all kinds of materials. Available in standard stock sizes or custom built for special jobs. Let Bath representatives help with your unusual threading problems...or write us direct!

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
28 Grafton St., Worcester, Mass.

SIMPLEX

DIESEL ENGINE CONNECTING RODS are difficult to bore to modern standards of accuracy and finish. Here, in one machine, all rough and finish boring, facing and chamfering operations are performed in minimum time.



The machine is a SIMPLEX 3U 2-way Precision Boring Machine with left-hand table mounted on hardened dovetail ways for rough boring, chamfering and facing one side of both ends. The piece is then reloaded on the right side of the fixture. The right-hand unit finish bores, chamfers and faces the other side. Heavy precision boring spindles, with powerful drives from 7 ½ HP motors, provide excellent finish and accuracy at low unit cost.

PRECISION BORING MACHINES

SIMPLEX MACHINE TOOLS DIVISION

STOKERUNIT CORPORATION

4528 West Mitchell Street

MILWAUKEE, WISCONSIN

Precision Boring Machines, Planer Type Milling Machines, Special Machine Tools

You will be amazed at the performance of the REDESIGNED *Cleveland* END MILLS

ILLUSTRATIONS OF VARIOUS NEW STYLE END MILLS—WRITE FOR DESCRIPTIVE BOOKLET

STRONGER! CUT FASTER! CLEAR CHIPS BETTER!

Much Greater Durability and Accuracy!

The new *Cleveland* End Mills are far superior to any you have ever used! They have been completely redesigned to give you strength, speed and accuracy that were never before obtainable! Many months ago we set out to design a different and better end mill. Neither time nor effort was spared in patient development work. We even worked out a new technique for testing the cutting qualities and the stamina of end mills. Users are enthusiastic about the results: Less breakage, many more cuts per grind, consistent accuracy . . . with up to 50% *increase in feed.* For high speed, low cost operation, use the new *Cleveland* End Mills on your next job. Contact our Stockroom nearest you, or . . .

Telephone your Industrial Supply Distributor

STRONGER
No sharp corners or points where localization of stresses might occur. Minimum amount of metal has been cut away.

MORE DURABLE
New-style clearance supports the cutting edge; assures against "flaking" or "chipping out."

LONGER LIFE
Radically new flute shape and chip clearing ability reduce wear on the cutting edge, thus maintaining consistent accuracy.

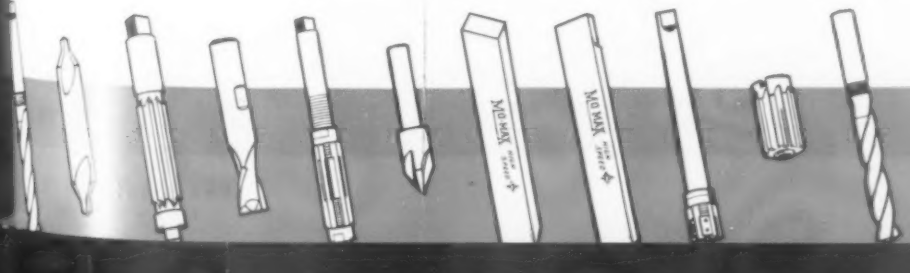
CUT FASTER
New flute shape gives maximum cutting qualities at increased rates of feed.

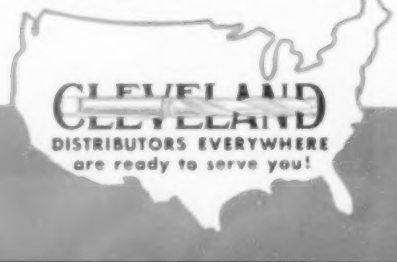
CLEAR CHIPS BETTER
Redesigned flutes are machine polished. There are no pockets. Chips are free to move.

GREATER ACCURACY
New clearance and accurate machine polish of flutes result in closer control of size.

THE CLEVELAND TWIST DRILL CO.
242 East 49th Street • Cleveland 14, Ohio
Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 11
E. P. Barrus, Ltd., London W. 3, England

ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS





GEAR PRODUCTION HIGHLIGHTS

SHEET No. 107

Cutting-Shaving-Checking-Lapping

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

New Production Line Gear Shaver For Heavy Duty Gears

Designed as a PRODUCTION machine, the new Michigan Model 873 rotary gear shaver (Fig. 1) brings to the finishing of heavy duty gears the ability to turn out such gears faster, more accurately and at lower cost. Completely automatic in operation, the 873 will handle spur or helical gears and involute splines of from zero (with 10″ cutter or larger) to 18 or 24 in. diameter, and with face widths ranging up to 15 in. Once the machine is set up for a given gear type, it is necessary only to load the gear between centers and push a 'start' button to complete the entire operation.

Features of the new Michigan 873 include ability to shave gears by any of three methods—

1. UNDERPASS—(Fig. 2) tangential feed; one roughing and one finishing pass usually enough for any gear (up to 4″ face). For finishing close shoulder gears, etc.; evenly distributed cutter wear.
2. TRAVERPASS—(Fig. 3) combined tangential and axial feed of the cutter. Evenly distributed cutter wear; cutters narrower than underpass. (Gears up to 5″ face)
3. TRANSVERSE—(Fig. 4) infeed; rapid approach plus a slower intermittent infeed. For finishing widest face gears (up to 15″ face) with narrow cutters.

Curve Shaving. Ability to curve-shave (crown) either narrow or wide face gears by any of the above three methods. Adjustable power-driven sine-bar mechanism rocks the work table about a center pivot for transverse and some traverpass shaving. Others curve-shaved by use of reverse-crowned cutters.

Floor Space. Greatly reduced compared with previous machines designed for handling large gears.

Controls. All controls located at front of machine.

Faster Cutting, due to inclusion of a 'rapid approach' feed in the machine cycle, and automatic in-and-return feed.

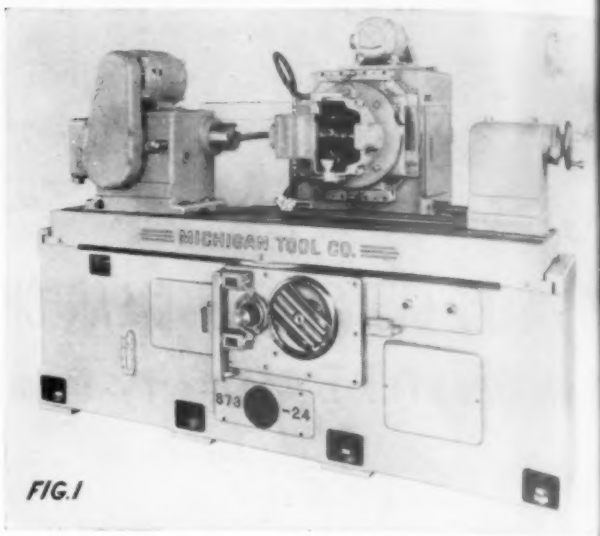


FIG. 1

Internal Gears. Special interchangeable cutter head provides for finishing internal gears on the 873.

Adjustments of the 873 have been kept simple for fast setup. Crossed axis setting is speeded by adding a five ten-thousandths indicator to the conventional vernier arrangement. Any of the three shaving methods may be selected by rotating the slide for the cutter head into proper position, mounting the correct cutter, adjusting center distance (by hand wheel at front of machine), and setting machine cycle. Limit switches regulate cutter reciprocation and head infeed.

Specifically designed for production line operation, the machine enables the use of unskilled or semi-skilled operators, further reducing costs. The operator merely loads the gear between centers and starts the machine by pushing a button. At the end of the complete machine cycle the operator merely reloads. Machines are so designed that an overhead crane or hoist can be used to lower heavy gears directly between the centers.

For further information on the new 873 gear shaver, ask for Bulletin No. 873-49.

FIG. 2

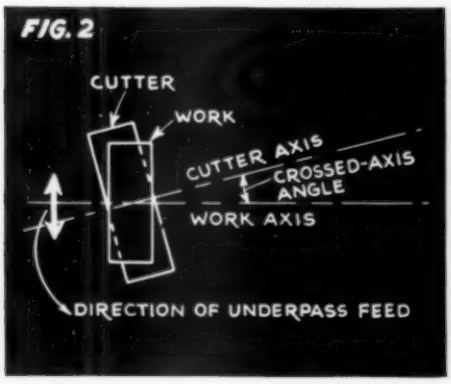


FIG. 3

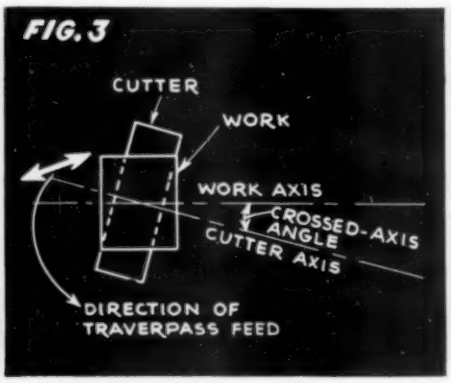
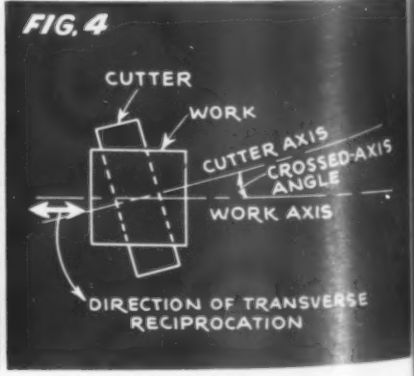


FIG. 4



A Snap Gage that is way out in front and at a price that is right

For years you've seen snap gages — both with and without Indicators — that really do *not* answer your needs. You've wanted a simple gage that was foolproof, rugged, and easy to handle — *and at a right price.* Here it is: Federal Model 1000! All our research, all our know-how in gage-making, all your wants, likes and dislikes, your demands and your gripes have been carefully considered to make this an outstanding Gage. Model 1000 is "IT", the right gage at the right price.

There are no tricky gadgets — Model 1000 is simple, easy to set and easy to use. It's rugged and fully guarded to withstand the roughest handling. It feels and handles like an old fashioned conventional gage but it's years ahead in design and performance. Model 1000 is completely new and up-to-date in every detail . . . newer even than any other Indicating Snap Gage.

Model 1000 has everything — visibility, positiveness, simplicity, lightness, toughness — it's dead to temperature changes and above all *accurate.* You'll like it when you see it and you'll like it more when you use it.

No other Indicating Snap Gage can match Model 1000 in usefulness. Five sizes cover the full range from 0 to 6". Think of the number of old-style conventional gages each Model 1000 can replace — think of the savings, too!

Federal Model 1000 All-Purpose Snap Gage does a *better* job at less cost. Its price will surprise and please you. Send coupon attached to your letterhead for complete descriptive bulletin and price of this definitely modern Snap Gage.

MODEL 1000 SERIES

— THE SNAP GAGE YOU WILL EVENTUALLY USE!

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SEND THIS COUPON TODAY

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Name ..... Title .....

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LOWER COSTS OF PRODUCTION OF INSPECTION

WITH THESE
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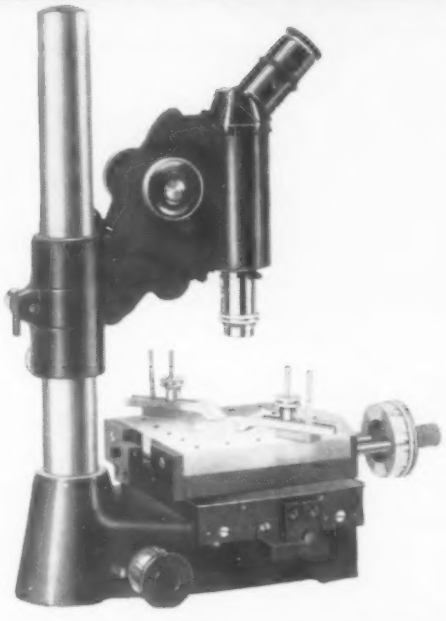


TOOLMAKERS' MICROSCOPE

A sturdy shop instrument especially designed for the machinist and toolmaker. It is used for precision linear measurements and, when fitted with the protractor eyepiece, for precision angular measurements. Objects and movements are seen in their natural aspect and direction . . . not reversed as in ordinary microscopes. Both opaque and transparent objects of regular or irregular contour can be measured. It is ideal for measuring parts which would distort under pressure of the most delicate instruments.

Operation is exceptionally simple and fast. Linear measurements to ±.0001" can be made by means of the cross slide stage, controlled by two micrometer screws, and angular measurements to ±1 minute of arc (1'). Various other attachments are available to meet special measurement problems. Catalog D-22.

New PARA-PLANE GAGES

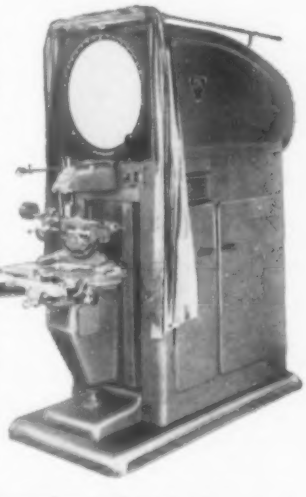
Now you can have "laboratory" accuracy of 0.000001" in the determination of flatness and parallelism of reflecting surfaces . . . with production-line *simplicity* and *speed*. So simple that an unskilled operator can make measurements after a few minutes of instruction.

Two sizes of Para-Plane Gages are available. *Bulletin* D-224.

New STEREOSCOPIC WIDE FIELD MICROSCOPES

Provide clear, sharp, three-dimentional, unreversed, magnified images. Used extensively in industry for greater speed and accuracy in small parts assembly operations, inspection of tools and finished parts, and precision curacy in small parts assembly different models for many uses. *Catalog. D*-15.

CONTOUR MEASURING PROJECTOR

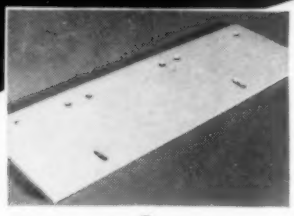


No other projector can match its accuracy (angular measurements to ± 1 minute of arc with a protractor screen, and direct linear measurements to ±.0001" over a range of 4" x 6" with the cross slide stage.) Dimensions, angles, and profiles of production-run parts can be compared directly with a *traced outline* of the projected image of the master part, or with a large scale drawing superimposed on the screen. Inaccuracies are found quickly...simply.

WRITE for complete information on these five important optical aids designed to help you save time and money. You may be paying many times over their cost in lost time and rejects. Send your request to Bausch & Lomb Optical Company, 763-J St. Paul Street, Rochester 2, New York.

BAUSCH & LOMB
OPTICAL COMPANY ROCHESTER 2, N.Y.

Only WALES Fabricators PRODUCE THESE ASTOUNDING TIME STUDIES



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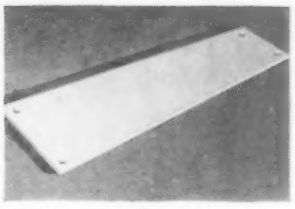

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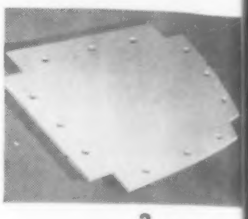

3

Compare these to your Methods

1 Part shown at top left with 6 holes and 2 slots was produced in only 44 seconds. What a record!

2 Center illustration of work with 4 holes was produced in only 29 seconds. What a way to cut production time and costs!

3 Illustration at right shows a sheet with 12 holes and 4 notches and was produced in only 2 minutes. *All these astounding time studies were made, not by Wales-Strippit but by a company that has a Wales Fabricator in their own metal fabricating department.*

WALES FABRICATORS

PUNCH . . . NOTCH . . . NIBBLE . . . BLANK

up to ¼" thick mild steel

There is nothing like it, this Fabricator is revolutionary! Wales exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation, ...so unique, in fact, that vibration and noise is practically eliminated at 165 strokes a minute. This drive plus the Wales patented "Quick-Change" System make possible these startling, "never-heard-of-before" time study figures.

It's too big a story to tell on this page, so write for fully-illustrated, functionally-colored catalog 10-A and discover why production schedules of this fabricator have been more than doubled.

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

393 PAYNE AVENUE, NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

Specialists in Punching and Notching Equipment

Fifth in a series of Unusual Grinding Wheel Operations

Ready for the dotted line!

Photograph of Nib Slotting Operation Courtesy of The Esterbrook Pen Company

Slitting fountain pen nibs to allow for the proper flow of ink is a very exacting operation. This precision job is another example of the versatility of a grinding wheel.

Whatever YOUR grinding problem may be, BAY STATE can solve it . . . fast. Possibly the exact specifications to meet your requirements can be supplied directly from large stocks either in Westboro, branch warehouses, or from our distributors strategically located throughout the United States.

Send us your grinding problems. We can help you.

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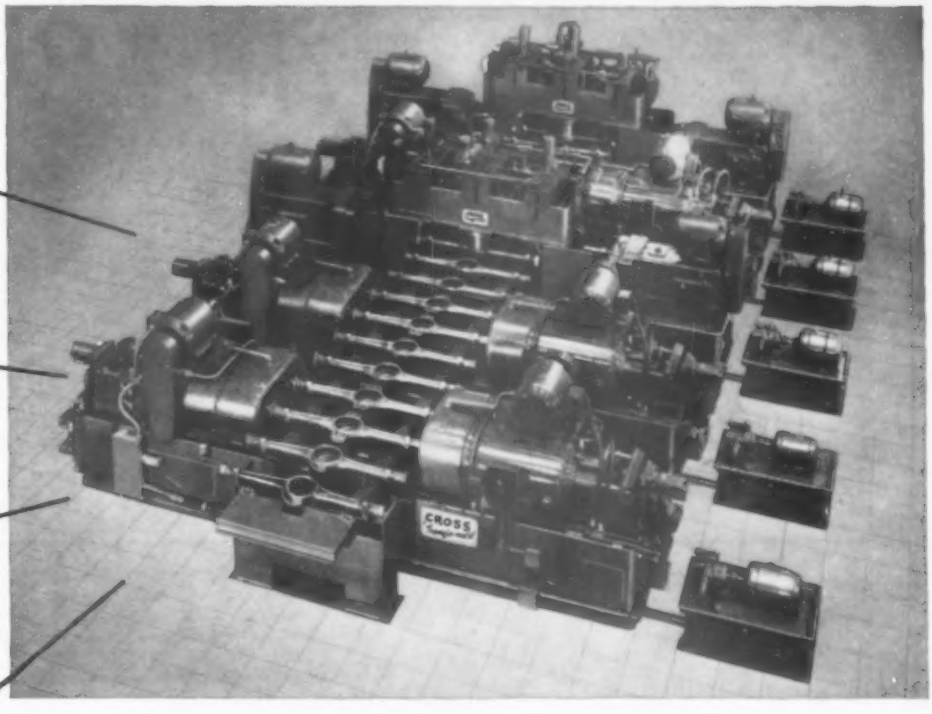
CROSS TRANSFER-MATIC

150 AXLE HOUSINGS PER HOUR WITH 1 OPERATOR

LOWER CAPITAL INVESTMENT

EXCEPTIONAL FLEXIBILITY

SIMPLIFIED MAINTENANCE



Another cost-cutting application of VICKERS HYDRAULICS

The Cross Transfer-matic illustrated here uses Vickers Hydraulic Controls in making substantial reductions in the cost of machining axle housings.

A hydraulic transfer mechanism automatically advances the housings (two at a time) from one machine to another. Hydraulic circuits of the individual machines provide for correct progressive positioning and clamping together with the traversing and feeding of the tool slides. Interlocks assure accurate positioning and secure clamping before cutting operations begin . . . also clearance of all tools before transfer to next station.

Exceptional flexibility is provided in that machines can be added, removed or shifted. Transfer mechanism is independent and moves work only from machine to machine. Locating and clamping are done by work holding fixtures integral with each machine.

Indicative of the many advantages of Vickers Hydraulics are gasket mounted Vickers Control Valves that simplify installation, save space and make adjustment easier. Vickers Power Units are compact "packages" that simplify hydraulic system design and reduce costs.

Vickers Hydraulics are particularly adapted to provide the complex motions and operations needed in highly automatic machines. Get in touch with the Vickers Application Engineering Office nearest you for information on how Vickers Hydraulics can improve your machinery.

Representative Vickers Hydraulic Pumps and Controls Used on Cross Transfer-matic


Power Unit, Bulletin 46-43a


4-Way Valve, Pilot Operated, Solenoid Controlled, Bulletin 48-27


Flow Control Valve, Bulletin 45-35


Sequence Valve


Check Valve


Pressure Reducing Valve

3989

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

SEE HOW ILLINOIS TOOL WORKS

FAST INDEX HOBS

WILL REDUCE YOUR GEAR PRODUCTION COSTS!

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Here is a detailed discussion, complete with diagrams and tables, of the performance characteristics of multiple thread Fast Index hobs. Learn how you can speed up your gear hobbing operations and take advantage of the full capacity of your equipment... to reduce costs! Also included is information on the TOOLGRAPH* chart, a method developed by Illinois Tool Works for electrically graphing individual hob accuracy. Send for your copy and see how Illinois Fast Index hobs will fit your process.

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OOL WORKS

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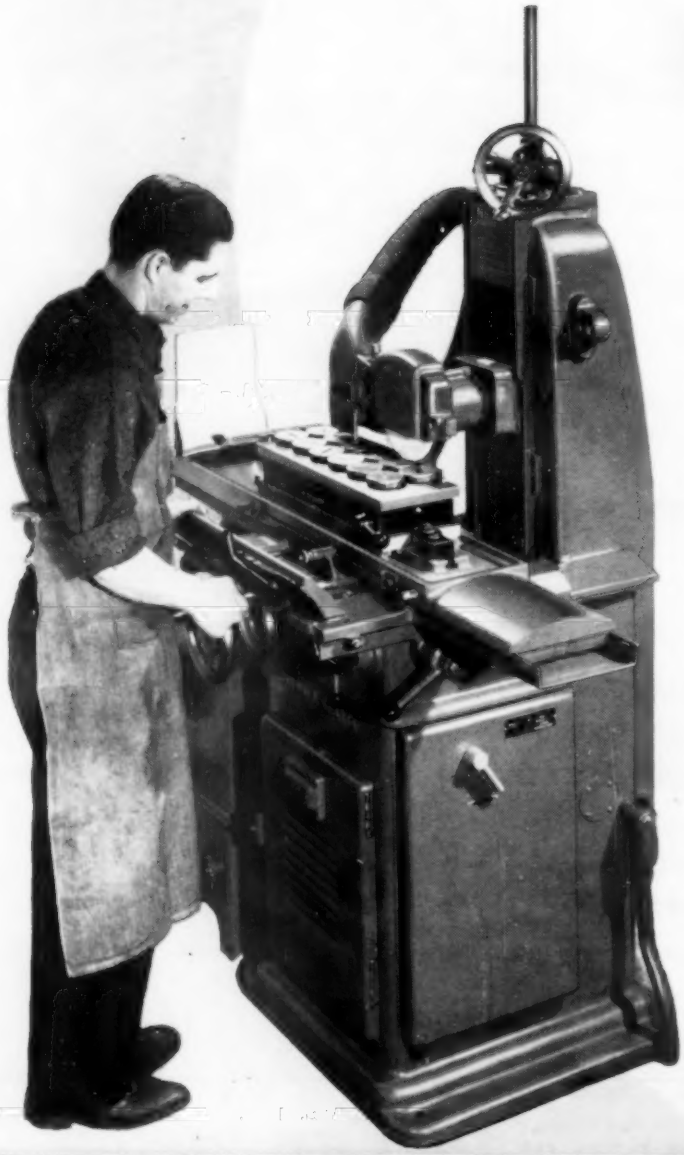
ENGINEERED CUTTING TOOLS

Mark Reg. U. S. Pat. Off.

for trouble-free surface grinding under extra dusty or severe operating conditions . . .

The New 2L and 2LB Surface Grinding Machines with Built-in Protection



Here are two new Brown & Sharpe Surface Grinding Machines with two important, built-in features for positive protection against dust, grit and severe service conditions. In addition these machines have all the highly-productive features of the popular Nos. 2 and 2B machines.

The new machines Nos. 2L and 2LB have full automatic lubrication and strategically-placed dust guards. These features reduce maintenance costs and extend machine life . . . valuable production and investment-protection advantages.

Like the Nos. 2 and 2B, these machines are made for efficient surface grinding with precision and fine finish on small and medium-size work.

CAPACITY: Grinds work to 18" long, 6" wide and 9½" high, using a wheel 7" in diameter. No. 2L (illustrated) has automatic feeds; No. 2LB, hand feeds only.

BROWN &

AUTOMATIC LUBRICATION !

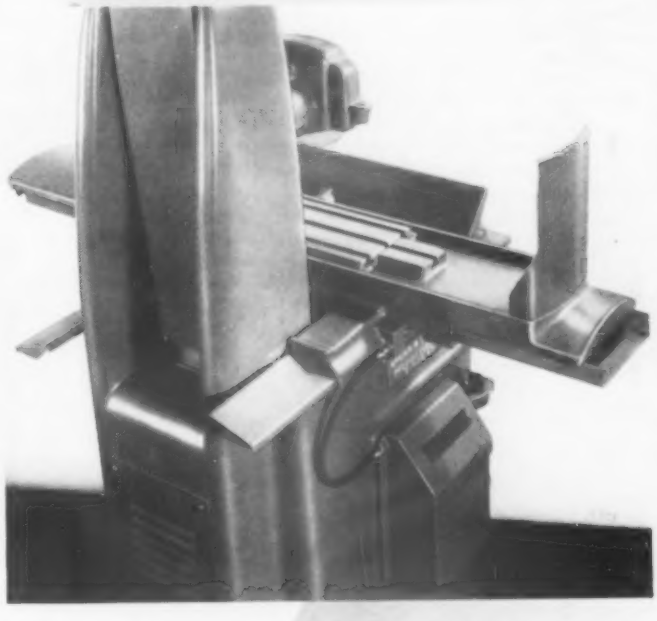
Lubrication of the 2L and 2LB is never a chore or a worry. All moving parts and adjustable surfaces automatically lubricated by plunger pump from reservoir on left side of base. Convenient sight indicator on right side of upright shows operation of oiling system. Oil is filtered before being returned to reservoir.

AUTOMATIC LUBRICATION. Pump and filter are located in compartment on left side of machine.

DUST PROOFED !

Extra precaution has been taken to protect these machines from dust and dirt. Table ways are completely guarded. Saddle and upright ways are similarly protected. Elevating mechanism completely enclosed.

WRITE FOR DESCRIPTIVE BULLETIN . . . illustrating both the 2L (with power feeds) and the 2LB (with hand feeds only). Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.



DUST PROOF COVER GUARDS. Table and saddle ways are fully protected against abrasive dust.

. . TYPICAL PROVEN FEATURES INCLUDE

- Removable unit-type precision wheel spindle; plain or antifriction bearing type; interchangeable.
- Alternate choice of spindle drive; with motor in base; with motorized spindle.
- All controls and adjustments conveniently located. Electrical controls enclosed in separate housing.
- Versatile. Several money-saving attachments.

SHARPE B·S

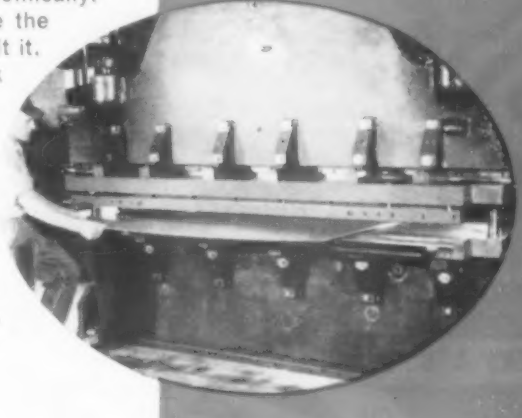
Indenting polished steel sink decks with a *Special* DANLY DIE SET!

A unique die set installation...
enables Geneva Modern Kitchens, Inc., of Geneva, Illinois to minimize changeover time in stamping a wide variety of sink deck sizes.

For a finish forming operation, production men at Geneva Modern Kitchens, Inc. were faced with the problem of indenting a wide range of sink deck sizes economically. A big precision die set, big enough to handle the largest size, was the answer . . . and Danly built it. With 2½" diameter leader pins and a 3¼" thick shoe, this 112" by 25" special Die Set embodies the precision and accuracy standards of the famous standard Danly Precision Die Sets.

And this is only a single example of how Danly's special facilities can help solve the die and stamping problems that arise in your shop. Take advantage of die set designing and manufacturing experience accumulated in more than 25 years of service to the stamping industry . . . bring your special die set problems to Danly.

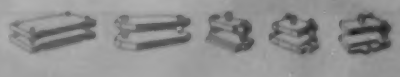
Stainless steel sheets are fed by hand. With only simple punch and die changes, this Danly die set accommodates a complete range of required sink deck sizes. Change over time is minimized.



Send for this free bulletin on Danly's special die set machining service today!

DANLY PRECISION DIE SETS . . . Standard and Special

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILL.



67 Chisel

withstands shock, wear and heat

These small, two-piece dies sink thousands of "dimples" in the aluminum skin of aircraft sections. They make conical depressions so that rivet heads can be driven in flush with the surface to provide maximum streamlining. Operated at a temperature of 600 F, the dies also do a spot-annealing job, relieving the local stresses set up in the thin aluminum-alloy sheets during the dimpling operation.

Bethlehem 67 Chisel is used for this job because this chrome-tungsten tool steel has high shock-resistance . . . it resists wear . . . it has good red-hardness . . . it is easy to machine and heat-treat.

67 Chisel is a versatile tool steel. It's suitable for such hot-work tools as headers, piercers, drop-forge die inserts and forming equipment where operating temperatures are below 1050 F. It is also excellent for cold-work tools like chipping chisels, swaging dies, battering tools, shear blades, punches and forming dies. Carburized for extra wear-resistance, 67 Chisel is the first choice for master hobs used in cold-hobbing cavity molds.

Hardened at 1750 F and oil quenched, it has a Charpy impact value of 180 ft-lb and a Rockwell-C hardness of 56.5 after tempering at 400 F.

Typical Analysis:	C	Si	Cr	W	V
	0.50	0.75	1.15	2.50	0.20

67 Chisel is available in many sizes and sections in our mill depot . . . and it's also kept in stock by many of our distributors. Get complete information from the nearest Bethlehem sales office or tool steel distributor. Better still, order a test bar and see for yourself how tough 67 Chisel really is!

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor:
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BETHLEHEM STEEL

67 Chisel . . . one of Bethlehem's Fine Tool Steels

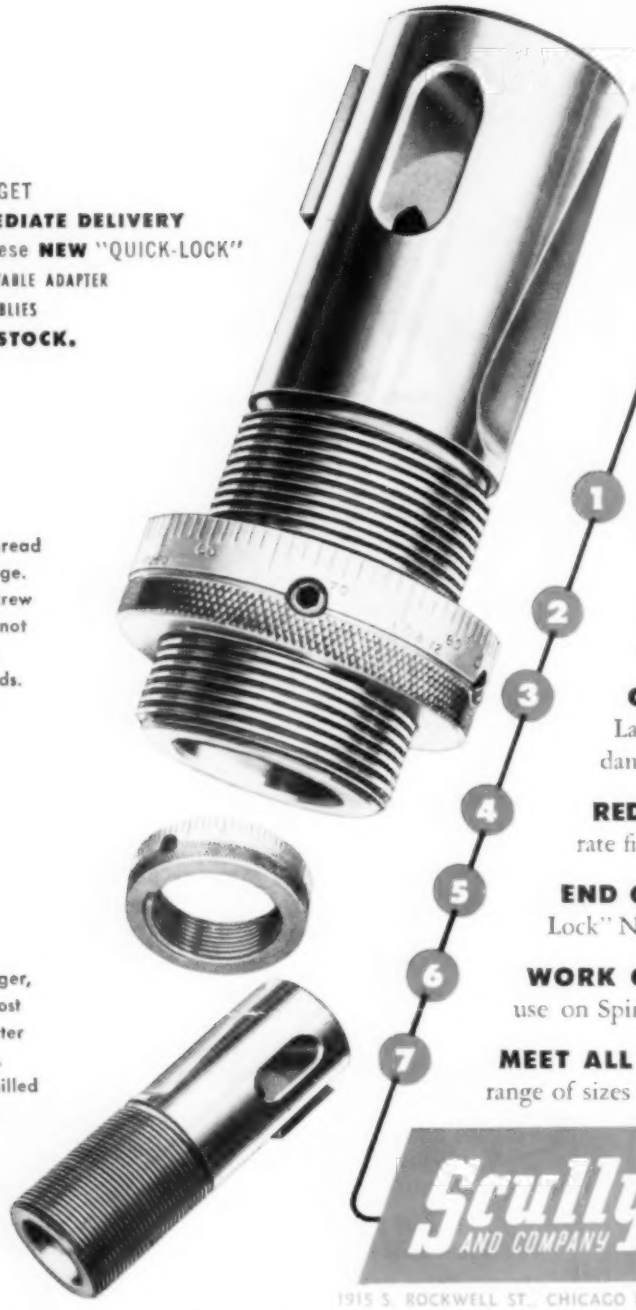
NEW "QUICK-LOCK" ADJUSTABLE ADAPTER ASSEMBLIES

for multiple spindle machines

by SJ SCULLY-JONES

7 COST CUTTING advantages!

YOU GET
IMMEDIATE DELIVERY
of these **NEW** "QUICK-LOCK"
ADJUSTABLE ADAPTER
ASSEMBLIES
FROM **STOCK.**



No thread damage. Set screw does not touch threads.

Stronger, low cost Adapter body. No milled slots.

Your initial cost, set-up time, replacement costs and other economy factors were considered in the design and manufacture of these *New* Scully-Jones "Quick-Lock" Adjustable Adapter Assemblies, that give you seven money-saving benefits.

1. **LOW INITIAL COST.** Savings in manufacturing costs, which we effected by eliminating 4 milled slots in adapter body, are passed along to you.
2. **REDUCE YOUR SET-UP TIME.** Quickly adjusted friction-type nut, locks instantly *any place* on adapter threads.
3. **CUT DOWN YOUR REPLACEMENT PURCHASES.** Last longer; no milled slots to weaken adapter body; no thread damage with *New* "Quick-Lock" Nut.
4. **REDUCE YOUR REJECTS.** National Acme Threads assure accurate fit. Squareness of top face of nut to threads, prevents distortion.
5. **END GUESSWORK ON FINE ADJUSTMENTS.** The "Quick-Lock" Nut is calibrated in steps of .001" for infinitely fine adjustments.
6. **WORK ON CLOSE CENTERS.** Small diameter of nut permits use on Spindles operating on close centers.
7. **MEET ALL YOUR REQUIREMENTS.** Available in wide range of sizes to fit all popular Multiple Spindles.

SEND FOR New Descriptive BULLETIN Containing Prices and Specifications

Scully-Jones AND COMPANY

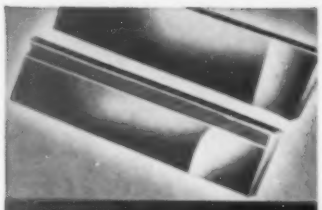
1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R-805

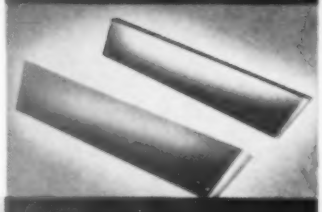
YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

You can get these Special-Purpose tools *made of Abrasion-Resistant* HAYNES STELLITE Alloy

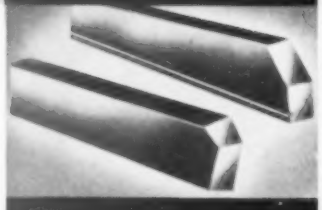
Trade-Mark



GROOVING TOOLS



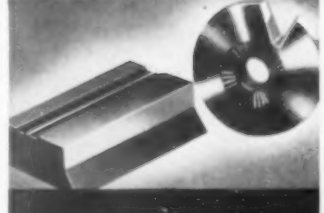
CUTOFF TOOLS



BORING AND REAMING BLADES

SHELL END MILLS

COUNTERSINKS AND SPOT FACERS



FORM TOOLS

Besides a complete line of standard tool bits, tool tips, tipped tools, and milling cutter blades, HAYNES STELLITE alloy is also available in a large variety of special tools for many different purposes. The tools illustrated at the right are only a few examples of the many forms in which this well-known alloy is supplied. Many types of milling cutters, core drills, counterbores, and similar tools are also available—and all tools are made accurately to your specifications.

HAYNES STELLITE alloy—composed of cobalt, chromium, and tungsten—is a high-speed cutting metal for machining ferrous and non-ferrous materials. The alloy has proved particularly suitable for turning, facing, boring, grooving, milling, and forming. It is inherently hard. And since its hardness does not depend on heat-treatment, tools made of HAYNES STELLITE alloy retain their cutting ability even at red heat. This unusual combination of properties—and a good balance of edge-strength and toughness—makes possible heavy cuts at high speeds. This, in turn, means high production at low cost per piece machined.

If you would like complete information on styles, sizes, and prices of HAYNES STELLITE alloy tools, write for a copy of the booklet, "HAYNES STELLITE Metal-Cutting Tools." Our staff of experienced tool engineers will gladly give assistance on your machining problems, if you will contact our nearest district office.

HAYNES alloys

TRADE MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

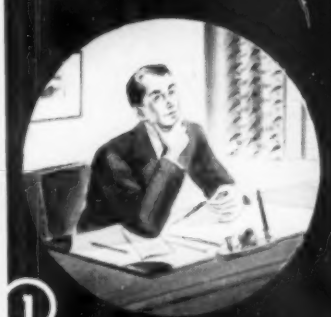
UCC

General Offices and Works, Kokomo, Indiana

Sales Offices: Chicago — Cleveland — Detroit — Houston — Los Angeles — New York — San Francisco — Tulsa

The registered trade-marks, "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

Three Steps TO PRODUCT SUCCESS



1 IDEA

2 DESIGN or REDESIGN and DEVELOPMENT

3 PRODUCTION

Design AND DEVELOPMENT OF THAT *NEW* PRODUCT

PROBLEM: COST TO MANUFACTURE

Company A planned volume production for a hard-to-manufacture product. It achieved the volume—*but not without prohibitive costs.* Smooth-flowing, economical production was an impossibility. Thorough production studies would have made this obvious at the start.

PROBLEM: MATERIAL

Company B was given an idea for a "product natural". There was a waiting market with no competition. Company B produced it—only to find that the price was higher than people would pay.

If knowledge of new material developments had been applied early in the design stage, the product would have been properly priced—made of more economical and practical materials.

PROBLEM: SERVICE TEST FAILURES

A product that would win the glamour award of the industry was the dream of Company C. Dies, fixtures, tools, and special machines were made and were turning out a truly beautiful product . . . Then—tests of pilot models found that it failed in service. Back to the drawing board it went—at great cost in time and money.

PROBLEM: COST TO DEVELOP

Company D had a product in mind that was sure to meet with customer acceptance. The company found its costs to develop the product running very high. It, therefore, abandoned what would have been a very salable product. Knowledge of new production methods, materials, and processes would have surmounted these obstacles, which Company D could not hurdle by following craft traditions.

Redesign AND DEVELOPMENT OF THAT *OLD* PRODUCT

PROBLEM: LACK OF SALES APPEAL

Company E decided that its dipping sales curve indicated a need for careful review of the distribution and sales methods of the product. Careful study of competitors' products showed a lack of distinctive design in any of them . . . A redesign of the product along new style lines brought sales back to normal, then pushed them on to new heights.

PROBLEM: NEW USES

Company F had reaped profits on its old stand-by product for years. The product performed its function well; yet it was being squeezed out by new competitive products. The old stand-by regained its industry leadership when it was redesigned so as to incorporate new uses and conveniences.

PROBLEM: NEW DEMANDS ON PRODUCT

Company G was doing well enough for years with its product. Then, a trend developed which demanded that the product perform one of its functions with a new degree of perfection. Redesign, to incorporate the new demand, was called for. It produced the desired results.

PROBLEM: BETTER PRODUCTION METHODS

Company H had a product it built largely by hand. New competition forced a reduction of cost and an increase in sales appeal. Competent redesign effectively brought the product out of the tool room stage, onto the high production line, and back into the market.

FROM IDEA, THROUGH DESIGN AND DEVELOPMENT, TO PRODUCTION AND PROFIT—HAVE PIONEER HELP YOU:

PLANTS LIKE YOURS ARE USING THIS STAFF

ETERNAL ORGANIZATION
stablishment of the framework to execute management's olicies; simplification of routines to handle orders, records and eports with minimum paperwork; allocation of responsibility and uthority to prevent friction caused by overlapping controls.

RODUCT DESIGN AND DEVELOPMENT
ealistic comparison drawn between cost of developing and anufacturing a new product and probable realization of returns; xisting products redesigned for increased sales appeal by comrehensive analysis of appearance, function and performance.

RODUCTION METHODS
tudy of production sequence to eliminate, combine, change rder of, or simplify operations; analysis of basic process and ecommendations for machines, tools and accessories to compeently balance out production lines.

UALITY CONTROL
Compilation of accumulative tolerance charts to assure any roduct meeting established manufacturing limits; correct locaon of inspection points and setting of standards and proedures to keep scrap at absolute minimum.

OOL AND SPECIAL MACHINE DESIGN
Design of tools, dies, jigs, fixtures and gages to complement nd implement any machine; modern production problems conquered by specially designed machine tools incorporating ydraulic, pneumatic or electronic controls.

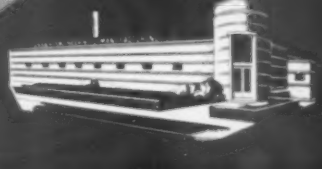
TIME AND MOTION STUDY
Determination of quickest and best work sequence with suggested improvements in workplace, methods and tools; study of operators' physical movements to correct bad operating practices, lessen fatigue and increase efficiency.

MATERIAL HANDLING
Unbiased recommendation and selection of equipment best suited to job—whether it be hand trucks, truck tractors, power-lift trucks, stackers, gravity-roll, power or chain conveyors, cranes or hoists.

PLANT LAYOUT
Flexible plant arrangements for steady progression of production obtained through preparation of process flow charts which clearly reveal bottlenecks; charts may be projected into template or scale model layouts for even more detailed study.

PRODUCTION CONTROL
Channeling work through a plant so sales schedules are kept in definite balance with production capacity; machine loads are accurately charted to give assurance that delivery dates can be met.

COST CONTROL
Determination of pertinent cost information, currently accurate, for use as a means of establishing prices and operating efficiency, to guide and guard present conditions and intelligently chart an organization's future course.



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The Old Production Line-Up	The Way It's Handled Now
1. Rough Broach	1. Rough Broach
2. Shape	2. Finish Broach
3. Shave	
Required Tolerance .0002"	Required Tolerance .0002"

EQUIPMENT USED:

1 Broaching Machine	4 Broaching Machines
18 Gear Shapers	
2 Gear Shaving Machines	

These are actual figures from a well known automotive gear plant which adopted the all-broaching procedure about 2 years ago. Since then savings have been spectacular.

Of course they don't use the garden variety of broaches. The savings and precision achieved would not be possible with ordinary tools.

This plant uses NALOY BROACHES each of which is good for 38,000 gears before it is retired. Naloy broaches have characteristics (and we can prove this) that the average broach shop just doesn't have the facilities to duplicate.

If you want Precision with maxl-mum economy, send for a Red Ring Broach Engineer.

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WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

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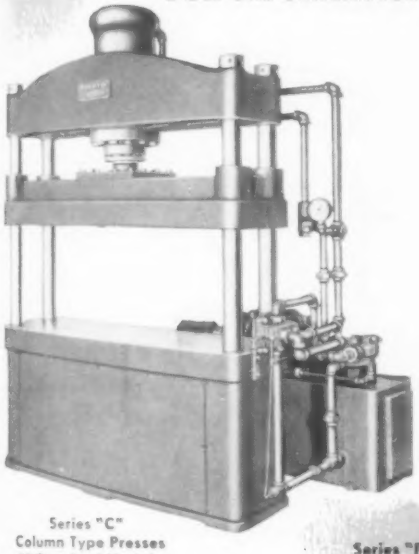
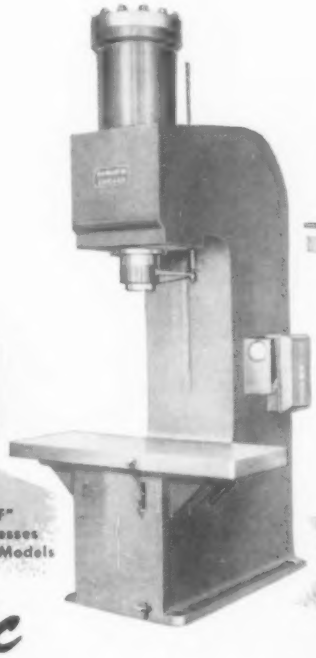
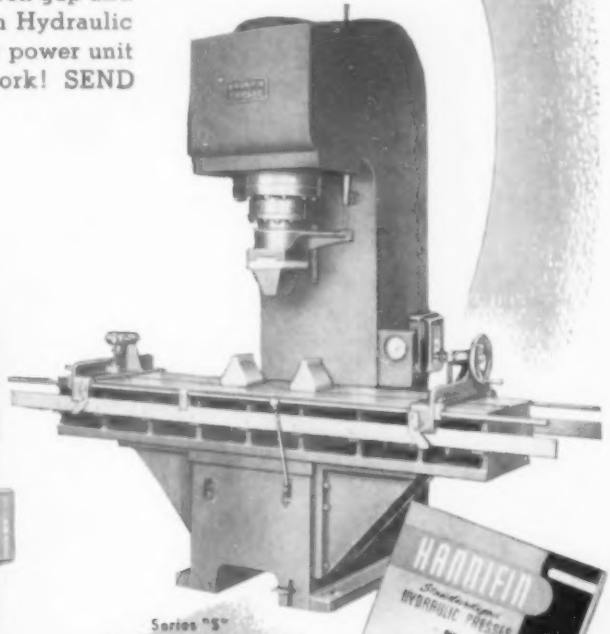


Series "C"
Column Type Presses
48 Standard Models



Series "F"
Forcing Presses
10 Standard Models



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17 Standard Models

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NORMALIZED FRAMES. Welded from steel plate. High strength and rigidity without excessive weight.

ARRANGED TO MEET YOUR NEEDS. Hannifin design readily permits modification to meet special needs.

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for: _____

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Company _____

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